Rubber Journal and International Plastics

VOL. 138 NO. 6 FEBRUARY 6 1960 Price 1s. Weekly

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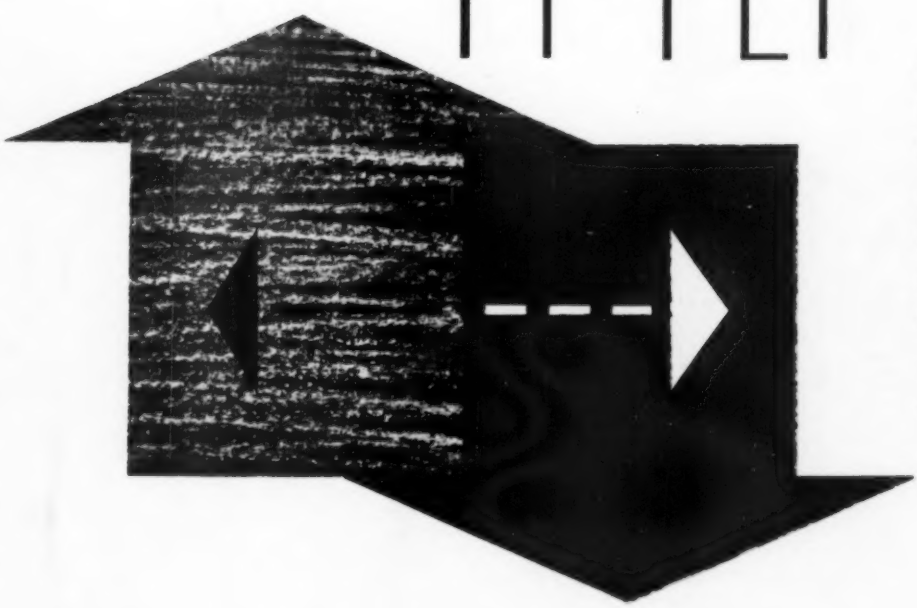

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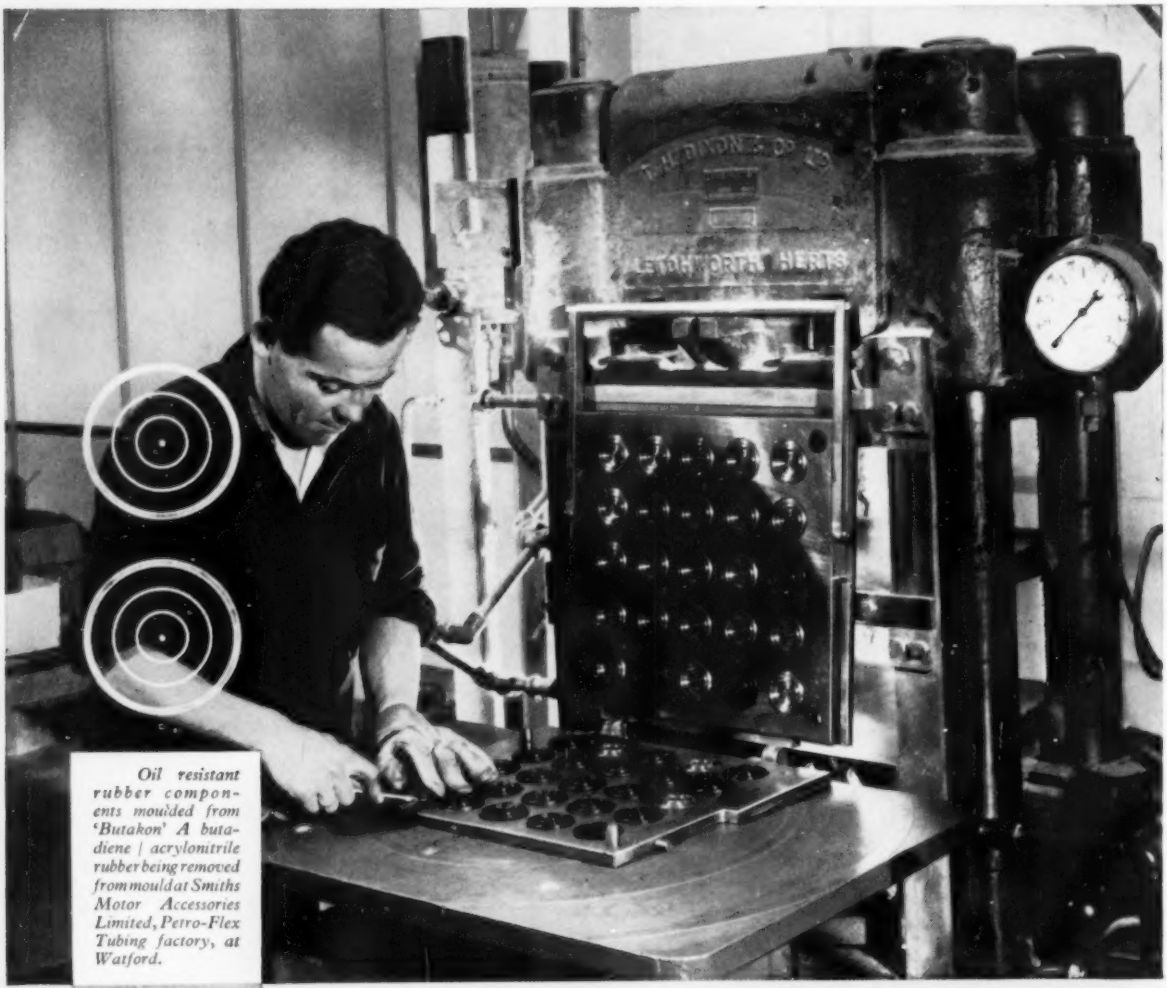

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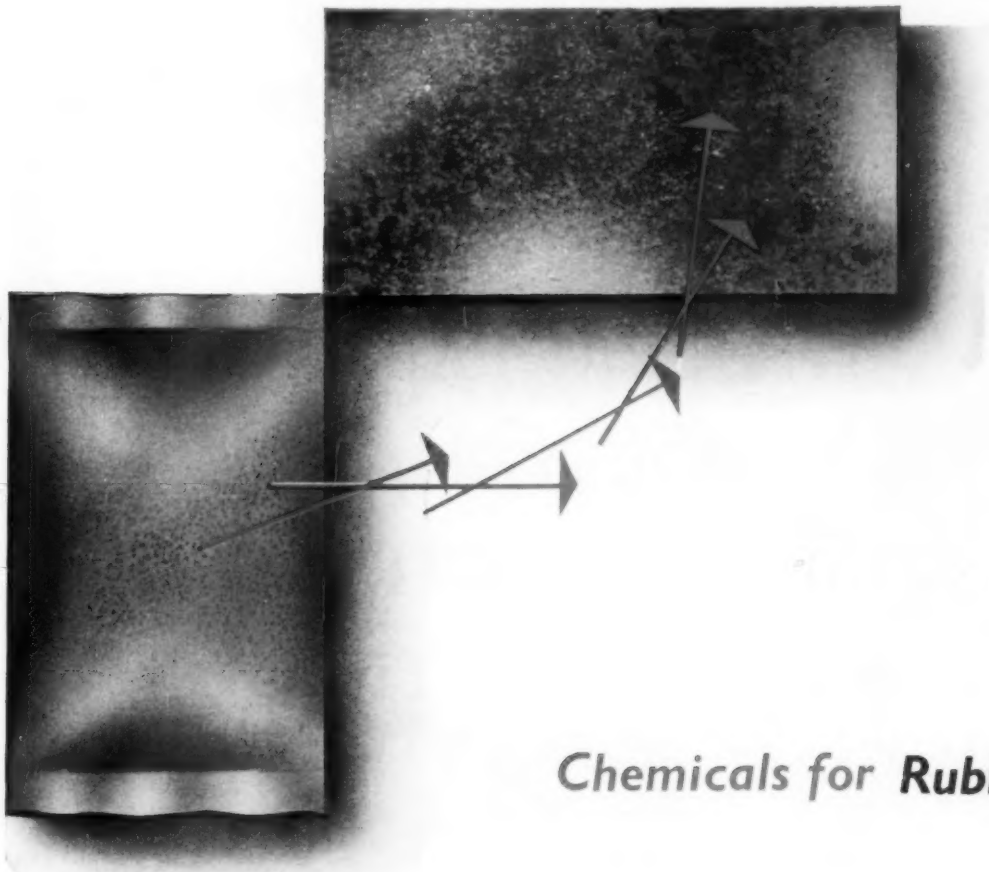

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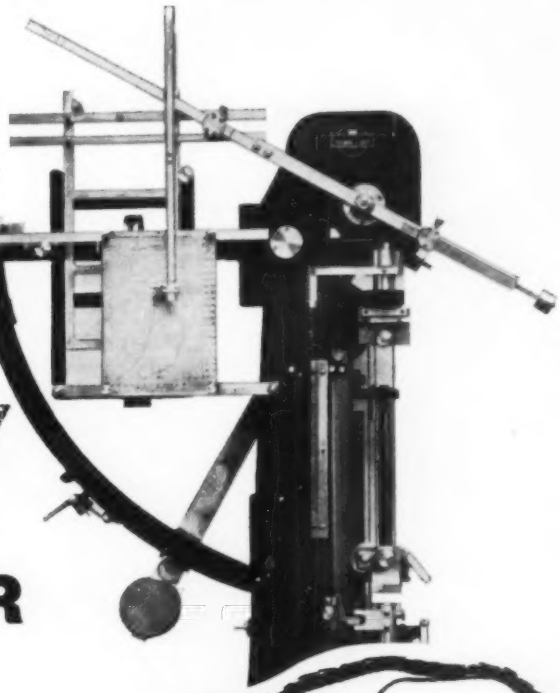

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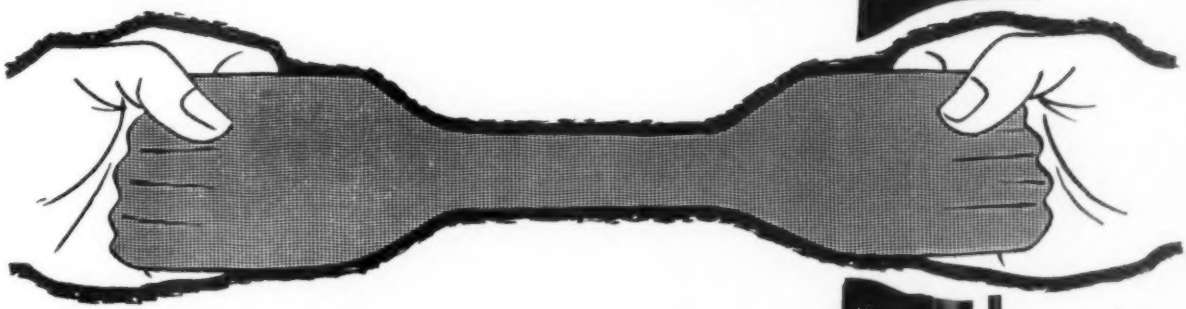

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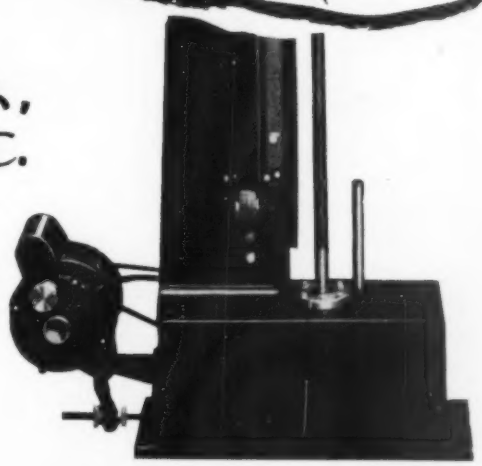

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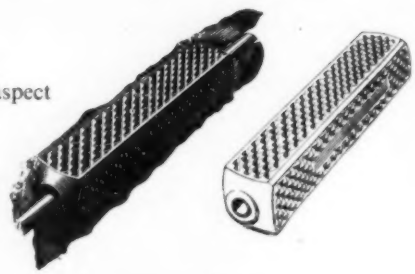

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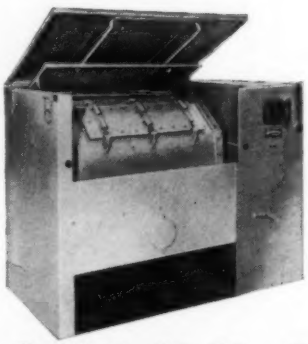

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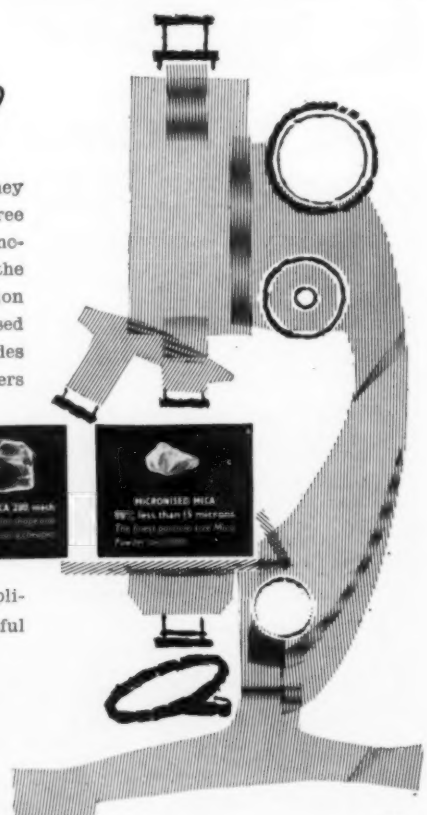

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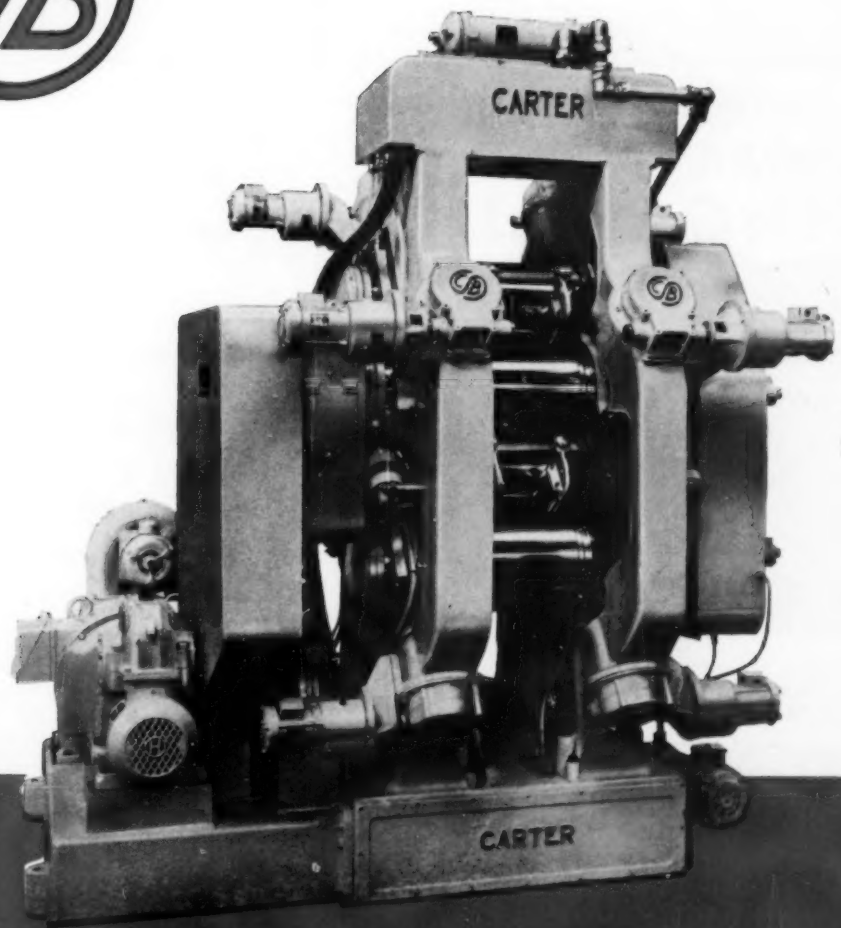

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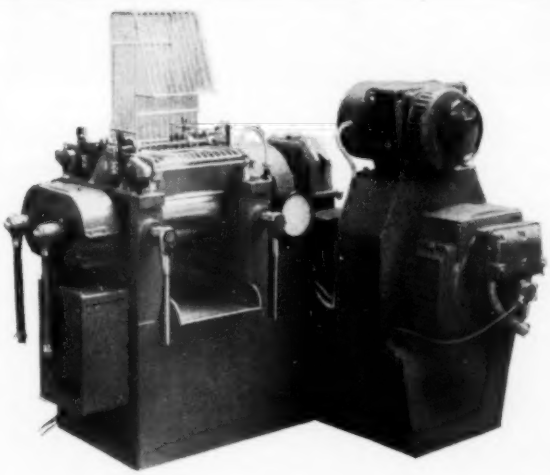

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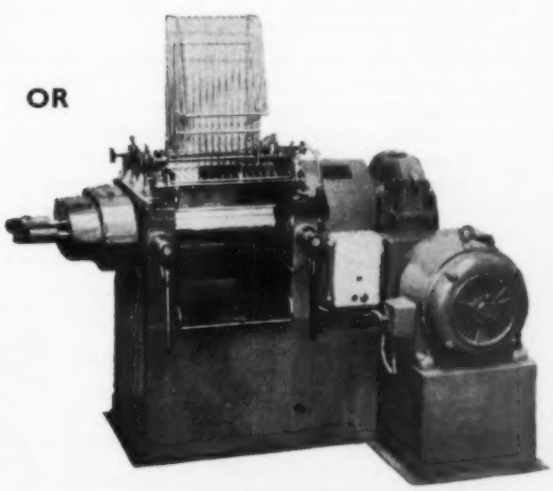

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Rubber Journal and International Plastics

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IN ITS 76th YEAR

February 6 1960

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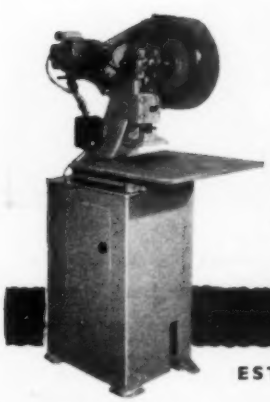

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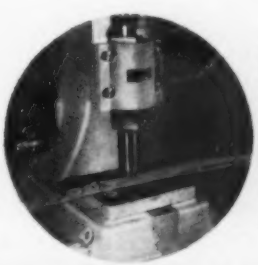

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NOTES of the WEEK

Rubber Industry Presents . . . Itself

THE presentation of three showcases by the Federation of British Rubber and Allied Manufacturers to the Science Museum (as reported elsewhere in this issue) can justifiably be described as a notable event. The British rubber industry, naturally, considers that it is well on the map. That is, however, true only in part. The public is not conscious of the activities of the rubber industry to anything like the same extent as it is conscious of, for instance, the plastics industry. The reason is not one of lack of glamour. There is as much glamour, interest and technological excitement in the rubber industry as in any other. It is merely that the rubber industry is a bit backward in putting itself forward. It appears to be afraid of making an exhibition of itself. This is a pity, the more so when one remembers that rubbers and elastomers now form one of the main classes of materials at the service of modern technology, comparable with plastics, metals and ceramics.

Eye-Appeal

ANY ONE who has any doubts about the 'eye-appeal' of the rubber industry should go along to the Science Museum. This rubber industry display is one that must be seen. Photographs alone cannot do it justice. Imaginatively put together and excellently presented, it is colourful, attractive and beyond all doubt among the most effective in the industrial chemical gallery. A few minor criticisms can be made. The idea of putting miniature products in the centre showcase, while these blend reasonably well with the finely executed mural, does not really come off. Fewer and larger, preferably full size, exhibits would, in our opinion, make a more telling impact. Such, for instance, as motor vehicle air springs and perhaps some of the more esoteric uses of the industry's main raw material as in rocket and missile fuels. It is, however, very evident that a tremendous amount of thought and effort has gone into the display, and congratulations are due in several directions. To Mr Stuart Covell, Federation director; to Mr E. S. H. Janes, chairman of the Federation's Publicity Committee, who, to our knowledge, has put in a prodigious amount of work; to the chairmen of the various associations; to Miss C. H. Chenhalls, Federation secretary, whose high-pressure enthusiasm and efficiency has helped greatly to bring the display into being in a remarkably short space of time; to the contributors from the rubber industry because if man-hours are taken into account the overall cost of the display cannot have been less than £10,000; and, last but not least, the designers and builders. The display will undoubtedly prove extremely popular. It cannot help but benefit the industry.

Plastics Record Year

NEW record levels for both output and exports were reached by the British plastics industry in 1959. Exact details of output are not yet known but a figure approaching 500,000 tons is forecast by the British Plastics Federation. This would represent a rise of about 80,000 tons on 1958 (output 415,600 tons) and would be the biggest for some years (production increased by 90,000 tons to 274,000 tons in 1954). Production has also more than trebled in ten years (1950, 155,000 tons). Exports of raw materials, in 1959, figures for which are now known, valued at nearly £40m., showed an increase of over £7.8m. on 1958. The volume, over 157,000 tons (compared with 123,000 tons in 1958), was also a record. Both value and volume are approximately double the rates of six years ago—1954, 73,000 tons valued at £20m. Biggest buyer in 1959, as for several years past, was Australia (£4.2m.) and, notably, exports to Hong Kong rose from below £1m. to over £2.6m. Other substantial markets were Sweden, over £2m. and the Netherlands and France, both over £1.8m. Raw materials include moulding powders, resins, sheet, rod, tube, and film, but not, it should be stressed, exports of plastics finished products. Domestic ware, toys, clothing, etc., are excluded, as are parts incorporated in other finished articles, aircraft, vehicles, ships, in which very considerably increased use is being made of plastics, and in electrical and radio and similar products. Exports of UK plastics processing machinery are believed to have totalled about £1½m. in 1959, also an increase.

Worldwide IRI

IN an appreciation of the work of the IRI published on September 6 1958, we said that the aims and achievements of the Institution had won for it universal acclaim and support and that its members were spread throughout the globe. The following January we learned that an autonomous Section had been set up in South Africa. Now (as reported elsewhere in this issue) other Sections have been established in Ceylon and Rhodesia. We note, too, that both the Australasian and Indian Sections are planning to strengthen their Sections during 1960. We now await the result of negotiations with representatives of the rubber manufacturing industry in Canada on the feasibility of setting up a Section in that country. Should that happen, the IRI will have achieved something we believe to be unique among scientific societies in being the first to establish itself in all countries in the British Commonwealth—each Section working freely within its local rules and all subscribing to a common Memorandum of Association.

NEWS *Briefs*

US TYRE YARN AND BUTYL RUBBER PLANS
FRENCH BLACK PLANT — CABLE PRICES GO UP
DUNLOP STRIKE ENDS — THAILAND EXPORTS

●**United States**—Esso intend to increase production of butyl rubber at their Baton Rouge, Louisiana, plant by 38,000 long tons. This will be a two-stage addition—20,000 tons by July 1960, and a further 18,000 tons by May 1961.

●**Canada** — Polymer Corporation plans to spend $6,100,000 on expanding its facilities in 1960. The funds will be provided out of the corporation's operations. Of the total $4,700,000 is for improvement of production units, further work on solution polymers and special types of rubbers, air and water and pollution prevention and expansion of employee facilities. The other $1,500,000 is for completion of projects started last year.

●**Northern Rhodesia** — Provisional recognition as a training centre for the IRI Licentiateship has been granted by the Council of the IRI to the Technical College in Bulawayo.

●**Thailand** — 14,379,622.7kg. of rubber of all grades were exported during November 1959, according to trade estimates. This compared with 15,570,573.8kg. exported during October.

●**United Kingdom**—The Board of Trade sold 5,950 tons of natural rubber from its stocks in January, compared with disposals of 8,577 tons in December. January sales comprised spot 330 tons, February delivery 1,358 tons, March delivery 2,065 tons and April delivery 2,197 tons. Stocks at the end of January including rubber sold for forward delivery totalled 77,969 tons, against 85,466 tons at the end of December.

●**United Kingdom**—London's Science Museum this week received from the British rubber industry a display representative of both producing and manufacturing sides. Three large showcases, already installed, were handed over officially by Mr H. G. W. Chichester-Miles, president of the Federation of British Rubber and Allied Manufacturers, the organization responsible for the display.

●**France**—The United Carbon Company announced plans to form a French subsidiary and build a 5,000,000 dollar carbon black plant near Rouen, in north central France. The new plant will have an initial rated capacity of 50,000,000lb. annually.

●**United Kingdom**—British Insulated Callender's Cables has raised its price of general wiring cables. The new prices for rubber and plastic cables and flexible cords have now come into effect. The increase, which is understood to be in the region of 5%, has been principally effected by a reduction in the discount available on the trade price. But, simultaneously, the trade price has been slightly reduced.

●**Hungary**—The Tisza Shoe Factory borrowed about £26,500 on a system of short term credits advanced by the Hungarian Investment Bank, to buy a new plant for producing rubber-composition soles. Now, increased output is expected to cover the initial cost within nine months.

●**France**—A new chemical company to produce basic materials for plastics from natural gas in the Lacq deposit of south western France has been set up by the Pechiney-Saint Gobain Association with the co-operation of Banque de Paris et des Pays Bas. The new company—Vinylacq—will make vinyl chloride from acetylene made by the Lacq chemical concern.

●**United Kingdom**—Plant has now been installed in the Kettering factory of William Timpson to make a range of vulcanized rubber footwear for which there is a growing demand, particularly in the USA.

●**United States** — Eastman Kodak's new polypropylene plant which is being constructed at the Texas Eastman Division in Longview, is expected to be on stream towards the end of this year. Anticipated annual production rate is 20 million lb.

●**Canada** — Cassiar Asbestos of Toronto announced a net profit for last year of over $3m. Exploration of Clinton Creek property has indicated reserves of over 5 million tons of high-grade asbestos ore, but mining has not yet begun.

●**United States**—The Dow Chemical Company has announced its entry into the tyre yarn business, saying it will start construction next month of a 'multi-million dollar' plant capable of turning out 12,000,000lb. of 'Nylon-6' filament yarn yearly.

●**United Kingdom** — The 2,000 semi-skilled rubber workers who went on strike at the Dunlop Rubber Company's factory at Speke, near Liverpool, decided on February 2 to resume work on Wednesday. The stoppage which began on January 29 was over the interpretation of a national agreement laying down a 42½ hour week with increased pay. Further negotiations are now to take place between the management and Transport and General Workers' Union officials.

'On your mark — Get set — GO!'—470

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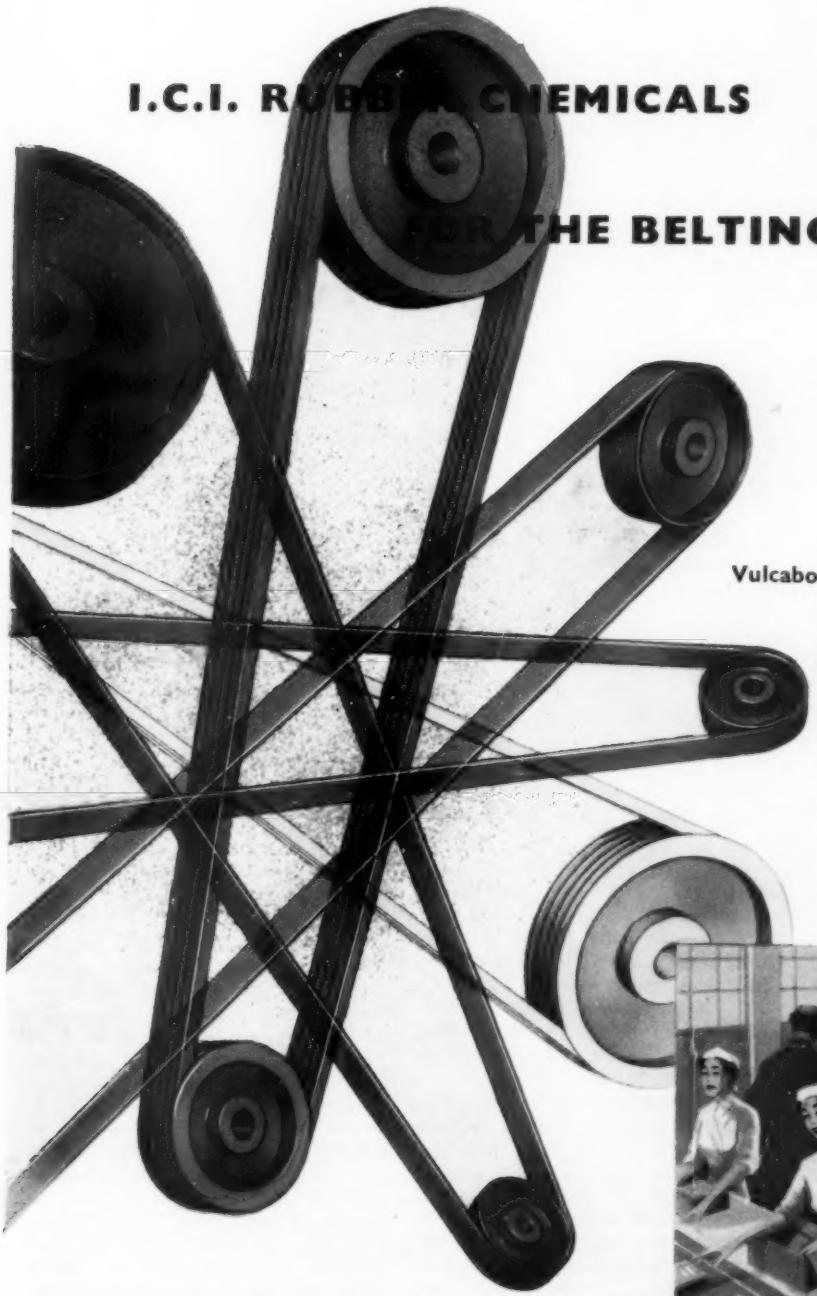

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Polythene

PART 1—DISCOVERY AND DEVELOPMENT

By L. HINDS, Ph.D., B.Sc., A.R.C.S. (I.C.I. Ltd.)

This is the first of a series of six articles on the history, structure and properties of polythene. Further articles will appear in consecutive weeks.

IT is only 26 years ago that the first minute sample of polythene was made. Today, after years of research, war years and a period of peace-time commercial expansion, the world consumption of polythene is over half a million tons per year.

The division of the polythene story into these chapters of research, wartime developments, and commercial expansion is a particularly apt one, and although the first two are now of historical interest only, it is worth remembering that the discovery of polythene was the outcome of classical research with no prime commercial objective. Chance played its hand: it produced polythene, and within only six years, its outstanding electrical properties had made possible airborne radar which was to play a vital part in winning the second World War.

After 14 years of peace-time commercial expansion polythene has become one of the most widely used of plastics materials.

General Properties

The properties of polythene belong to another chapter of this series, but it is interesting to consider that it is the *combination* of its properties rather than the properties themselves which make polythene an outstanding material. For example, polythene has very good high-frequency electrical insulation properties—but it is the combination of these with its flexibility and resistance to water and chemicals which makes it an exceptionally useful cable insulant.

A high-molecular-weight hydrocarbon, polythene behaves very much as might be expected: it is thermoplastic; olefinic linkages in the chain are susceptible to oxidation; generally it is chemically inert, but it is attacked slowly by oils and some chemicals; it is unaffected by water, and it has a high volume resistivity and a very low power factor. In addition to these properties polythene has been found to be very easy to mould and extrude on existing plastics machinery.

Polythene is partly crystalline and partly amorphous, and different proportions of these two forms represent materials of different rigidity. Many other plastics materials are either unalterably rigid, as are the thermosetting phenolics, or require plasticization, as does PVC, to give softer, more pliable compositions. The natural flexibility of polythene is particularly fortunate: it makes it suitable for cable insulation, film, paper coating, tubing and a multitude of moulded wares. Bottles moulded from polythene are flexible: the squeeze bottle is a luxury of the polythene age. In household wares, this flexibility is particularly attractive, and results in an unpremeditated boon to the housewife—quietness in use. As public taste changes, and the novelty of flexible objects is occasionally overshadowed by difficulties in handling, polythene manufacturing techniques have produced stiffer materials where these are required.

Applications

One of the features of the polythene story has been the unexpectedness of some of its applications. Whereas the polythene-insulated trans-Atlantic telephone cable might have been predicted in the early 1930's, it would have been difficult to predict that polythene would be used for doilies and dustpans, bottles and buckets, water tubing and toys, lampshades, film for packaging and for horticulture, and many other things.

Thermoplastics soften with heat but some of the applications of polythene emphasize the fact that, providing the service conditions are correctly assessed, it is often possible to design a thermoplastic article which will stand up to regular use at elevated temperatures; washing-up bowls, hot-water bottles, and even a kettle, have been designed successfully in polythene.

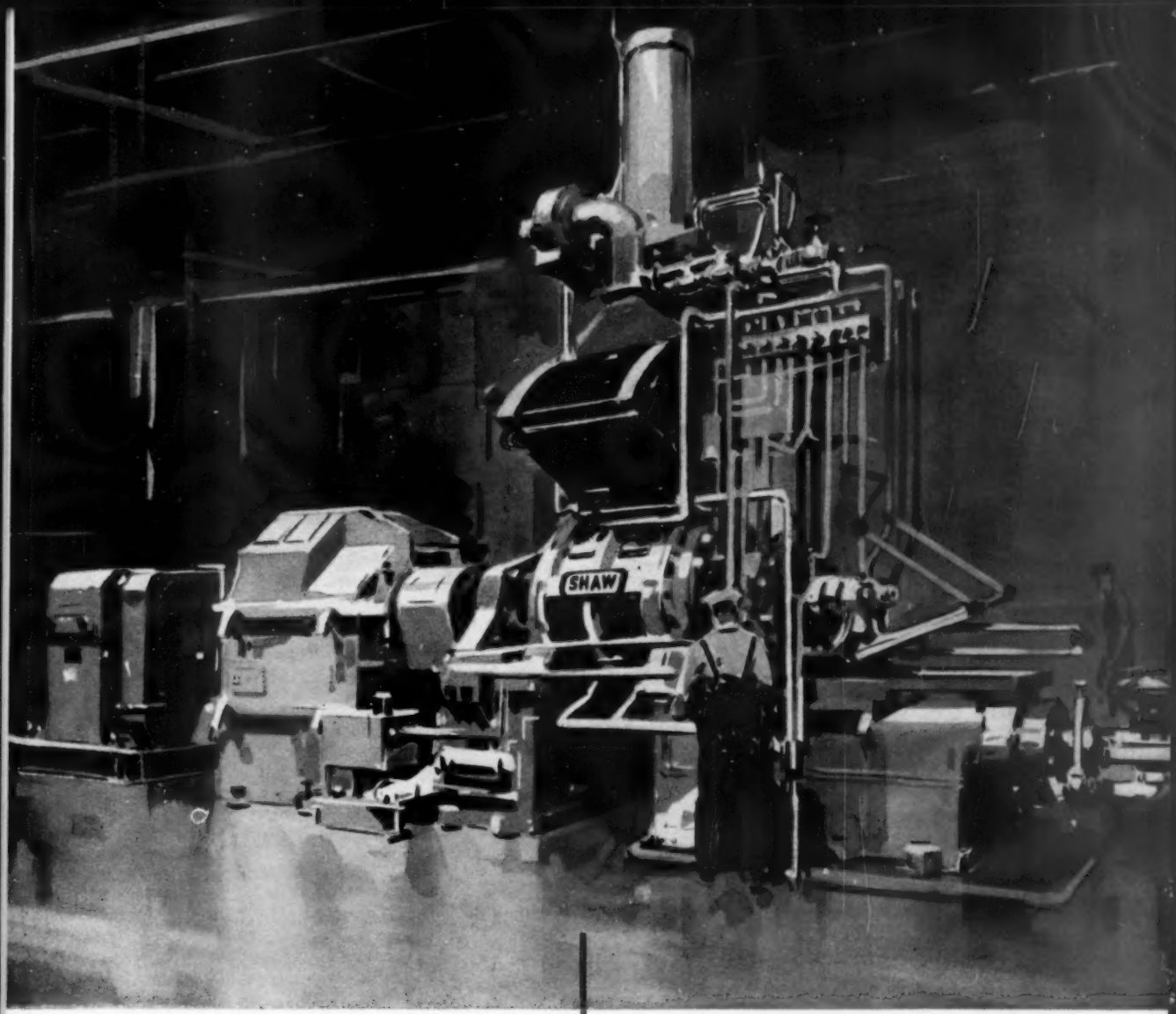
The public acceptance of plastics as materials in their own right, and not as substitutes, really began with nylon stockings, which were better in almost every respect than anything previously known. If the subsequent popularity of nylon clothing tended to place this material in the public mind in a class apart from the other plastics, polythene mouldings are probably the first important factor responsible for claiming for plastics generally a place of their own in day-to-day living.

New Polythenes

One of the most interesting aspects of the recent development of polythene as a raw material is the introduction of polymers of higher density than the figure of 0.92g./c.c., which, until recently, was accepted as normal. These higher densities have been achieved in three distinct ways. The first is by the use of supported oxide catalysts, which is covered by patents in the names of Phillips Petroleum Company and Standard Oil of Indiana; it enables polythene to be made at pressures in the region of 1,000lb./sq. in. instead of at 15 to 45 times this pressure as used in the normal high-pressure process. The second is by the use of special alkyl catalysts and atmospheric pressures —the Ziegler process. The third is by modifying the normal high-pressure reaction. The first process yields polythene in the density range 0.955-0.970; the Ziegler process gives material in the range 0.945 to 0.955, and the I.C.I. high-pressure process covers the range 0.900-0.955.

Although the density is accepted as the criterion of the differences existing between these new polymers and conventional polythene, the differences in use depend mainly on the differences in stiffness and temperature of softening. The higher stiffness of high-density polythene is of particular interest in many moulded wares, where either greater stiffness is required for a given thickness of section, or a saving in cost can be achieved by reducing the thickness of the section without any loss of stiffness. Although the increase in temperature-resistance of high-density materials is fairly small, it does straddle the temperature of boiling water and can, in some applications, bring polythene from being totally unsuitable to being acceptable.

In manufacture, the high-pressure process is such that it can produce both low and high density polythenes but it cannot produce polymers of the highest densities, such as can be produced by the low-pressure processes. In mouldings and in film, it seems at present that it is the materials of intermediate density that will command the most interest in future. In



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OVERSEAS AGENTS THROUGHOUT THE WORLD

P.2806

these applications, although rigidity and temperature-resistance are of importance, surface finish is found to be markedly improved in normal production by the use of intermediate-density polymers. The hazy appearance of low-density polythene film was at first accepted as inevitable, but it has recently been shown that this haze can be very considerably diminished by the use of intermediate-density material.

Production and Consumption

Before beginning a more detailed survey of polythene as one of the major plastics raw materials in the world today, it is appropriate to compare sales and production tonnages of polythene and other plastics in the UK, and how some of these tonnages have changed in the last year. The figures[1] given are for the year 1958.

The estimated sales of plastics materials in the UK and exports from this country total 415,000 tons, a 6% increase over 1957. This tonnage is divided among the major plastics as follows:

Thermosetting	Tons
Phenolics	66,000
Aminoplastics	52,000
Alkyds	46,000
Polyesters	5,000
Casein	1,500
Others	6,500

Thermoplastics	Tons
PVC polymer and compound	100,000
POLYTHENE	65,000
Polystyrene	33,000
Acrylics	15,000
Polyvinyl acetate	13,000
Cellulose acetate	11,000
Others (including nylon)	1,000

Polythene production in the UK at 65,000 tons represents an increase of almost 20% since 1957. Most of this polymer was made by I.C.I.; some was made at the Grangemouth plant of Union Carbide and relatively small quantities of high-density Ziegler-type polythene were made by Shell and high-density Phillips-type polythene by British Hydrocarbon Chemicals.

I.C.I.'s output was substantially increased in 1959 and a Monsanto plant to make low-density polymer at Fawley with 10,000 tons capacity began production during 1959. Shell's output of high-density polythene is being increased and a further increase of 11,000 tons capacity may be expected from the British Resin Products/B.P. Chemicals new Phillips-type high-density polythene plant.

The consumption of polythene in the UK was approximately 44,500 tons, a rise of 20 to 25% since 1957. The consumption of high-density materials was only 5% of this total; the advantages of the greater rigidity of high-density polymers have not resulted in an expected rise in popularity and moulders appear to have been reluctant to carry out the necessary changes to moulds designed for low-density polymers. The outlook for high-density materials is further complicated by the advent of intermediate-density polythene made by a modified high-pressure process, and by polypropylene, which may fulfil many of the high-density polythene applications.

In 1958 the conversion of polythene polymer into finished products by the various fabrication processes in the UK is illustrated by Table 1.

TABLE 1

	%
Mouldings	37
Film	29
Cable	16
Tube	8
Coatings	5
Bottles	3
Others	2

This article is intended to serve only as an appetizer and, as such, it must be a very incomplete survey of the points of interest in polythene technology. In the articles to follow in this series, some details will be given of the nature and properties of polythene, of the fabricating processes in common use today, and of the applications of the material in industry and in the home.

REFERENCE

[1] *British Plastics*, January 1959.

(To be continued)

TITAN AT OCCA

British Titan's exhibit at this year's Oil and Colour Chemists' Association Technical Exhibition will be called 'The Design of a Weathering Station.' Every paint manufacturer has had the problem of setting up an exposure testing station, but not many have had the opportunity to start on a completely new site, to build a special laboratory for controlling tests and to equip it with the best equipment that can be bought at a reasonable price. British Titan Products Company Ltd. were able to do this after more than 20 years of exposure testing, and the new station at Carlton is the result.

The exhibit will show the layout of the station, the design and method of construction of the exposure racks, the instruments that have been installed for recording weather conditions and for evaluating the behaviour of the materials on test.

Chemical Institute of Canada

Among the meetings which have been scheduled for 1960 by the Chemical Institute of Canada are, on April 8: Rubber Chemistry Division's Annual Meeting, Kitchener, Ont.; April 20: Joint Meeting, Quebec Rubber and Plastics Group and the CIC Montreal Section, Queen's Hotel, Montreal, Que., 'Industrial Development,' and, on September 8-9: 10th Canadian High Polymer Forum co-sponsored by the National Research Council and the CIC, Alpine Inn, Montreal, Que.

Motorists don't get the bumps they expect at this railroad crossing at Wooster, Ohio, USA —the crossing is made of rubber. This is the first time rubber pads have been laid on a curve, and Goodyear officials claim that it will last for 20 years. Ice will not hold on the pads, which are bolted into position with rubber plugs

Dynamic Testing of Rubber

NEW WALLACE ELECTRONIC MACHINE

By F. N. B. BENNETT

INTEREST in the new Wallace electronic dynamic testing machine for rubber was initiated as a result of oil leaks from the blade roots of an hydraulically operated aircraft propeller. It was suspected that the rubber seal was not capable of remaining in contact with the vibrating propeller blade after having been subjected to low temperature conditions due to the engine being temporarily stopped at high altitude.

It is reasonable to suppose that the dynamic properties of rubbers used for example, in anti-vibration mountings should be taken into account if the mounting is to function satisfactorily through the range of conditions it is liable to encounter in service. Failure to select the correct rubber, or to design the mounting to suit its job, can actually worsen the conditions the mounting was intended to alleviate. The dynamic testing machine offers a means of selecting both materials and design so that anti-vibration units can be designed to suit the load they must bear and to give satisfactory insulation through a given temperature and frequency range.

Fig. 1

Purpose

The purpose of this machine is to apply to a test specimen a dynamic strain which can be in tension, shear or compression according to choice. The dynamic strain is sinusoidal in motion and is controlled at a known frequency and amplitude.

The machine provides a means of evaluating rubber compounds under dynamic conditions so that materials may be specified to perform as nearly as possible a given function under given conditions. The machine can also be used to study the effect of design and shape upon the dynamic behaviour of moulded components.

Provision is made for testing at both sub-normal and super-normal temperatures with only the specimen subjected to this condition. Research has indicated that the dynamic properties of visco elastic materials are particularly temperature dependent.

Measuring Arrangements

The amplitude of the strain and the values of the resulting stress or load are measured electronically whilst the machine is in action. Readings are presented on meters or alternatively on a calibrated oscilloscope or recorder.

Energy loss may be calculated from the area of the hysteresis loop which can be reproduced on the oscilloscope. Provision is made for this same property to be evaluated quickly, conveniently and more accurately by measuring phase angle whilst the machine is in motion.

The machine has been designed to permit convenient adjustment of frequency, amplitude and temperature. Provision is also made for the adjustment and measurement of static strain and static stress. Under certain conditions of loading, dynamic components may be small compared with static components. In order that dynamic values may be conveniently measured, means are provided for separating out static components.

Principle

The machine is illustrated in Fig. 1, and diagrammatically in Fig. 2.

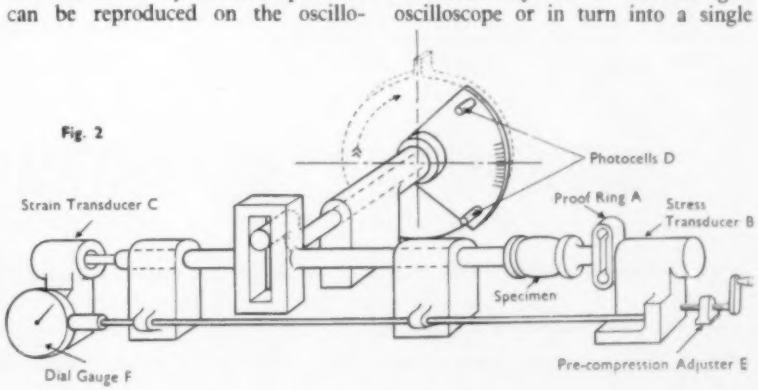
A revolving eccentric provides the sinusoidal displacement cycle whilst the specimen is located between one fixed and one reciprocating face or grip.

Stress or load is measured by deflection of the proof ring A. Attached to the proof ring is a displacement transducer B. The output from this transducer is amplified and compensated for the cross-sectional area of the specimen if the result is required in terms of applied stress. Compensation is also made for the loss of dynamic strain amplitude due to deflection of the proof ring.

Strain is measured directly by the transducer C. Static strain is applied by the handwheel E and is measured by the dial micrometer gauge F. This arrangement compensates for loss of static strain due to static deflection of the proof ring A.

The output from each transducer is amplified and can either be fed simultaneously into a double gun oscilloscope or in turn into a single

Fig. 2



gun oscilloscope. In order to ensure correct phasing at low frequencies the traces are triggered by an impulse derived from a photo cell.

Properties to be Measured

The parameters so produced are illustrated in Fig. 3, and the values which are measured are as follows:

(1) Static Strain — Indicated on the dial gauge F as explained.

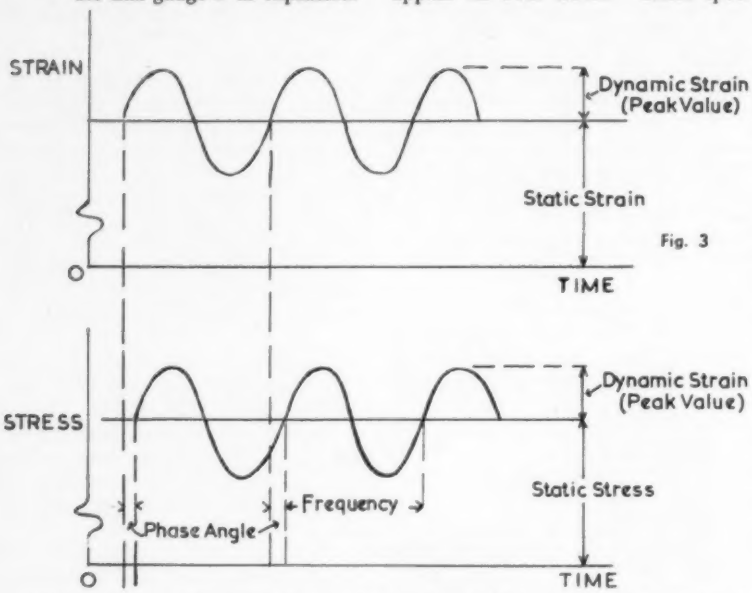


Fig. 3

(2) Static Stress — Measured directly by a calibrated electronic control which cancels out this component.

(3) Displacement Frequency — Measured from the parameters or more conveniently from a recorder chart speed or tacho-generator.

(4) (Peak) Dynamic Strain
(Peak) Dynamic Stress
Read directly from meters or alternatively from the parameters using a calibrated oscilloscope.

(5) Phase Angle

Phase Angle

'Phase Angle' is the angle through which the machine eccentric passes during the 'lag' between stress and strain. In Fig. 3, this angle is illustrated in terms of time. Phase angle is measured using a 'spotting' technique whereby light spots are made to appear on both traces. These spots are obtained from impulses received as a result of a peg on the flywheel passing between two cells and two light sources. The machine is so designed that the two photo cells can be rotated as an assembly (D) about the axis of the flywheel in a controlled manner. This movement causes the light spots to move along each trace.

The photo cell assembly is moved until the two light spots on one trace lie in a horizontal straight line (Fig. 4). A protractor scale is set to read zero. The photo cell assembly is moved again until the light spots on the second trace lie in a horizontal straight line (Fig. 5). The protractor now reads phase angle.

If the time base is deleted from the oscilloscope the traces appear in the form of vertical lines as shown in Fig. 6.

Procedure now consists of positioning the two spots of one trace on top of one another and then adjusting the photo cell assembly until the two spots of the other are on top of one another. In measuring phase angle in this manner only the light spots are of interest. This means that the traces can be amplified considerably thus facilitating accurate positioning of the spots.

In order that it shall be possible to measure phase angle at different stages in the displacement cycle the position of one photo cell on the assembly can be adjusted in relation to the other. If the two photo cells are moved closer together the peg on the flywheel will pass one cell just before the eccentric reaches the end of its stroke and the other cell just afterwards. (See Fig. 2) The two light spots will now appear at the top of the trace as illustrated in Fig. 7. As the photo cells are moved away from one another the light spots will move down the traces. In this manner it is possible to measure phase angle at any stage of the test cycle.

An accurate means of measuring the angular movement of the photo cell assembly is provided which achieves a particularly simple, accurate and reliable method of measuring phase angle.

Drive

The machine consists of a flat steel table to which are attached the rotating eccentric, the reciprocating push rod and all other accessories. This table is mounted on robust cast iron side frames.

A 3 hp electric motor is mounted conveniently beneath the table and

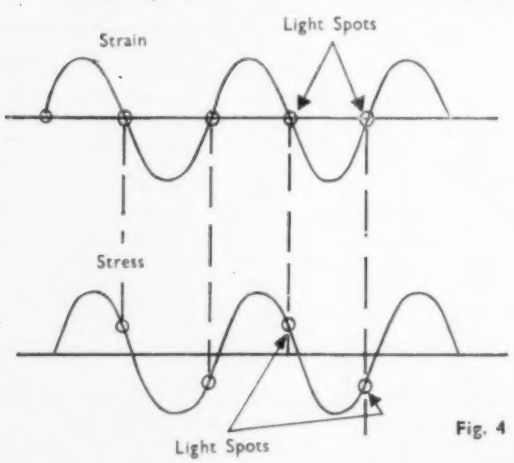


Fig. 4

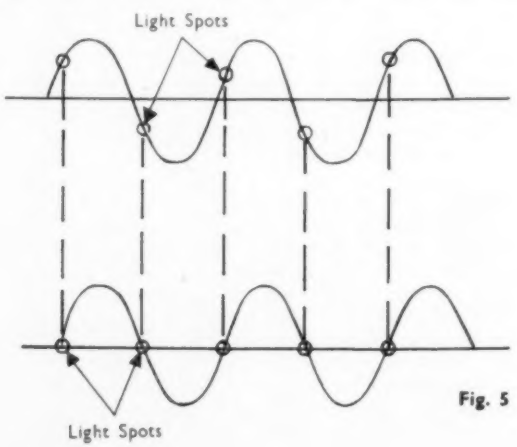
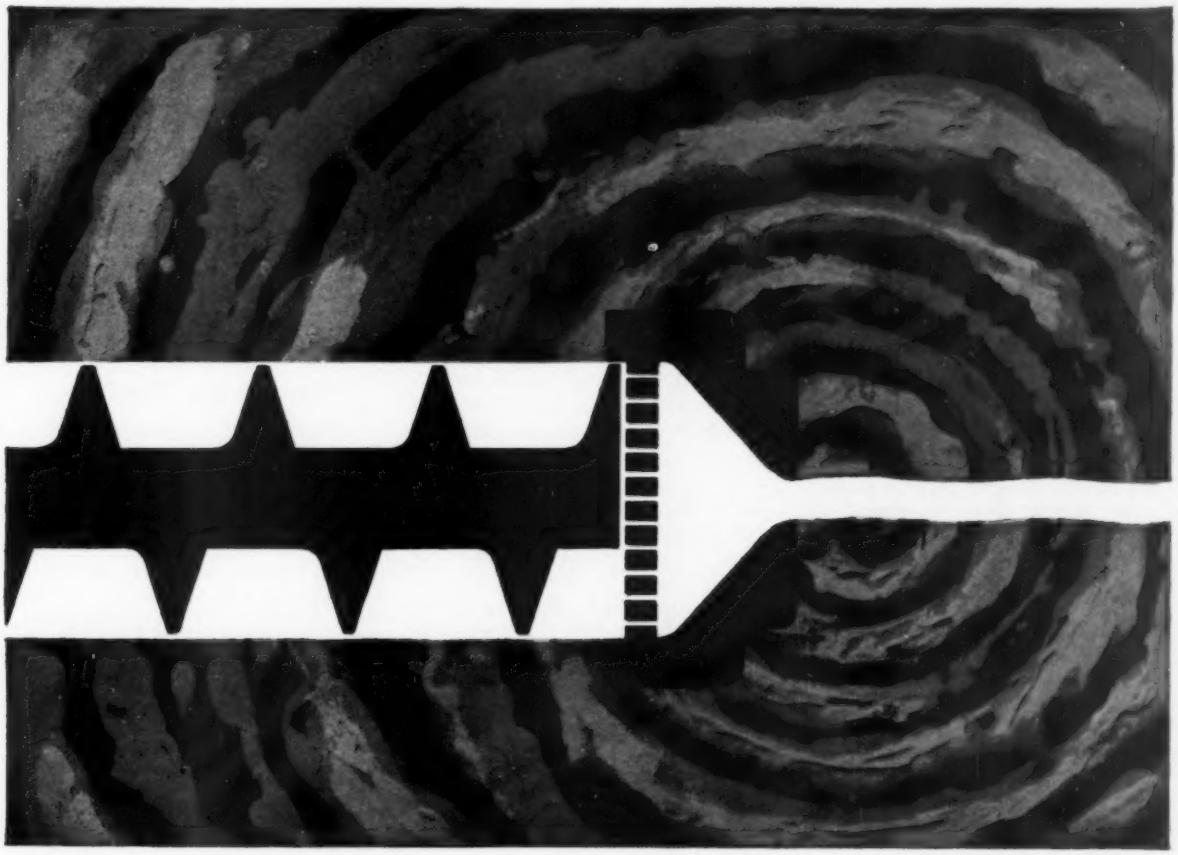


Fig. 5



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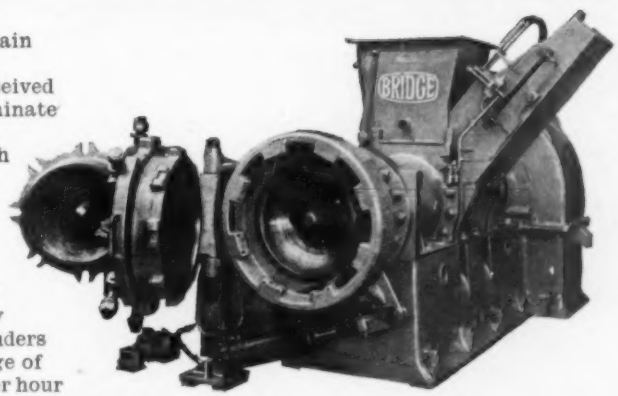

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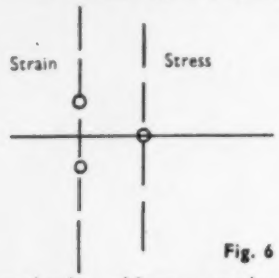

Fig. 6

conveniently without stopping the machine. Alternatively change pulleys can be used to avoid the expense of the Carter gear. Connexion between the motor, the gear and the machine is by V-rope drive for smooth and silent running.

Temperature Control

Two temperature control chambers are provided, one for sub-normal temperatures and the other for super-normal temperatures. These chambers are designed to fit neatly round the

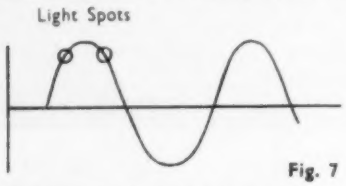

Fig. 7

specimen so that only the specimen is brought to the required temperature. Sub-zero temperatures down to −100°C. are achieved without difficulty by evaporating liquid nitrogen. Control is to within ± 2°C. using a special thermostat. Adequate provision is made to insulate the temperature chambers and to prevent excessive heat transfer to or from adjacent components.

Electronics

The electronic equipment is mounted in steel racking designed to be located conveniently near the machine. The only connexion between the two is a flexible multi-core electric cable.

Reference

RABRM Research Report No. 76. 'Dynamic Properties of Vulcanized Rubber.'

Rubber Cushioning

The report on the recent RABRM Symposium on Rubber Cushioning and Upholstery, which appeared in *RJIP* last week, was written by Dennis Young. Mr Young is design consultant to the Natural Rubber Development Board.

'Pneuride' Air Suspension

LEICESTER AMBULANCES

FOUR new BMC 30cwt. LD2 chassis equipped with 'Pneuride' air suspension have been supplied to the City of Leicester's Ambulance Authority by the Dunlop Rubber Company. This is the first time that any ambulance unit in Britain has been supplied with this type of vehicle and the order was placed after Leicester ambulance drivers had carried out a series of exhaustive tests on a prototype vehicle.

In this application the 'Pneuride' suspension, which consists of two convolute bellow type air springs made of nylon reinforced rubber and operated by a fan belt driven compressor, is fitted to the rear of the vehicle only. At the front the conventional leaf springing remains unchanged apart from a few minor modifications.

The 'Pneuride' suspension is particularly suited to ambulances and commercial vehicles by reason of its smooth ride and automatic levelling, no matter what type of load is being carried. Due attention has been given to roll-stiffness; and shock absorber settings have been arranged to suit the 'Pneuride' system. The need for periodic lubrication has been elminated by the fitting of rubber bushes at all points.

If for any reason there should be a failure in the air supply, rubber stops have been provided in the rear suspension so that axle location would be unaffected, and the vehicle could return to base without having to unload.

Design for Plastics

A Symposium arranged by Newton Heath Technical College and the Regional College of Art on 'Design for the Plastics Industry,' will be held at the Regional College of Art, All Saints, Manchester, on February 25 and 26. It will include the following topics: standards of design; design and the retail markets; production difficulties and possibilities; available materials and their influence on design. The course fee is £2 2s., and further details may be obtained from The Principal, Regional College of Art, Department of Industrial Design, All Saints, Manchester, 15.

Sir Walter Worboys has been elected to the Board and appointed a deputy chairman of BTR Industries. Sir Walter is chairman of the Council of Industrial Design and a director of the Westminster Bank.

This shoe factory in Accra, Ghana, is busy trying to keep up with the demand for sandals made of Melloroid PVC leathercloth, which are the latest fashion there. The most popular type is the patent leather effect whose mirror-like surface makes it well liked by the Ghanaians

business before pleasure...

PAN, the charmer. He delighted all the gods of Olympus. However, his pursuit of Syrinx, an Arcadian nymph, caused her to be changed into a reed—from which Pan made his pastoral pipes. Now, if it were as easy as that to produce the many kinds of pipes now required by industry and the products of industry, business for Dunlop would be pleasant indeed. Instead, years of patient work in the laboratory, in the workshop and the various fields of use has produced flexible piping of infinite range and purpose. Embracing the use of rubber and metal and silicon-hardened compounds, Dunlop piping is capable of working and flexing in high ambient temperatures and of withstanding considerable pressures. It is another example of the many products with which Dunlop serve industry.

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Natural Rubber's Future

'LONG TERM PROSPECTS VERY GOOD'— SIR JOHN HAY

A PROSPEROUS future for the natural rubber industry was forecast here by Sir John Hay after touring Guthrie group plantations and before leaving by ship for Britain.

In an interview with *RJIP* correspondent in Kuala Lumpur Sir John pointed out that it was common knowledge that at present the price of rubber was very profitable but he felt that the significance of this had been overlooked in that natural rubber was selling at a high price while synthetic rubber was in excess of supply. The shortage of natural had been met by releasing natural rubber from stockpiles.

Below Capacity

He pointed out that stockpile releases were being made at a time when synthetic rubber installations were working below capacity.

'In other words,' he said, 'there is a shortage of natural and an excess of synthetic yet the price of natural keeps up well above synthetic. That points to the clear conclusion that natural rubber has unique qualities that cannot yet be replaced by synthetic.'

This was a happy situation for the natural rubber industry and indications were that it was likely to continue for some time. It was generally agreed that the prospects for 1960 were good and to try to project beyond 1960 was in the nature of speculation.

Nevertheless they had tried to do so and according to their computations the increase in world natural rubber supplies between now and 1965 would be more than about 250,000 tons a year while the increased demand for rubber of all kinds, natural and synthetic, would be about one million tons.

This projected gap would be met by the greater use of synthetic and by continued releases from government stockpiles. But even if these things did happen it looked, upon these assumptions, as if natural was in for quite a good time for some years to come.

'This is a speculative opinion,' he said. 'But the long-term prospects of natural rubber are very good indeed.'

Of Malayan production, Sir John pointed out that at present Malayan output was about 700,000 tons a year and they expected this to be between 850,000 and 900,000 tons a year in 1965. This would make Malaya the largest producer of natural rubber in the world. He was not satisfied that at the moment Malaya was the largest producer because Indonesian figures were somewhat indefinite.

On natural rubber research Sir John said: 'We cannot neglect research, there is still a wide scope for what I term productive research for even at this advanced stage in the progress of the rubber industry nobody knows with certainty what is the function of latex in the tree.'

One of the subjects for research was how to increase the economic longevity of a rubber tree. If this could be done then the natural industry would be able to cut down on the heavy cost of replanting. There would not be such a loss of crop while old trees were knocked down and new trees grew to maturity.

'The remarkable thing is how long it takes to increase supplies of rubber,' he said. 'It takes the greatest part of a decade in knocking down old trees and planting new trees and that is why I stress increasing longevity. The present economic life of a rubber tree is about 33 years which gives a tapping time of about 26 years and if you can prolong that you will get more rubber more cheaply.'

The research, however, should be done by a central organization.

Sir John said that he agreed with the proposal by Sir Geoffrey Clay, the Controller of Rubber Research, to close down the rubber-in-roads programme in the USA. He had felt during his 1958 visit to the USA that there was not much promise in this direction. As for technical advisory services, he felt that natural producers had not much to teach the larger manufacturers.

Asked about the need for Malaya to diversify and not to have all its eggs in one rubber basket, Sir John said that too much of the Malayan economy rested on rubber. The only outstandingly successful alternative was oil palms and they had had some success in producing high-yielding oil palms.

Work Study

He did not agree that Malaya should immediately provide more money for research by increasing the cess on rubber exported from Malaya. Some of the money raised for the purpose of research had been used for somewhat remote purposes. In some respects the cart had been put before the horse. The important thing was to have a programme of research and then raise money for it. 'The money for any well-conceived research programme will always be forthcoming,' he said.

Sir John said that he did not agree with arguments that more attention should be paid to productivity and that work study teams should be invited to examine the plantation industry. This type of study had an application to factories. He had spent some time watching tappers at work and had been surprised by their deftness and speed. Their wages, too, were an incentive to work efficiently.

Monte Carlo Rally

The three winning Mercedes who covered the exacting and hazardous route over snow and ice from Warsaw to Monte Carlo used 'Tiresoles,' treated in the factory of Deutsche Tyresoles, GmbH, Frankfurt-am-Main. The treads provided incorporated the exclusive 'Wyresoles' claws.

Heavy duty polythene films manufactured by Fablon Ltd., 49 Park Lane, London, W.1, one of the Commercial Plastics group of companies, are being used extensively by building companies to protect site operations and personnel against the weather. In addition to the usual application of complete roof covering, Fablon films are being used to glaze windows temporarily as shown in the illustration

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This Is Us

RUBBER INDUSTRY'S OUTSTANDING PRESENTATION TO SCIENCE MUSEUM

A PERMANENT display representing the producing and the manufacturing sides of the British rubber industry was this week presented to the Science Museum, South Kensington, London. It occupies three large showcases in the industrial chemistry gallery, and illustrates the molecular structure of natural and synthetic rubbers; their production, compounding, and processing; the great variety of products thus obtained; and the vital part they play in modern life.

The display was handed over to the Director of the Science Museum, Dr T. C. S. Morrison-Scott, D.S.C., by the President of the Federation, Mr H. G. W. Chichester-Miles, at a ceremony held in the Council Room of the Museum on February 3 1960.

In the first of the showcases an accurate construction in bronze wire set against a black velvet background illustrates the twisted and tangled shape of a typical long-chain rubber molecule. Methods of compounding dry rubber and liquid latex are represented by three-dimensional models of a two-roll mill and a latex mixing vessel. Further models show in simplified form six of the main processes of rubber manufacture; calendering, extruding, moulding, tyre-building, whisking and dipping; and a rotating unit displays nine typical products in which the remarkable physical, chemical, and electrical properties of rubber are utilized.

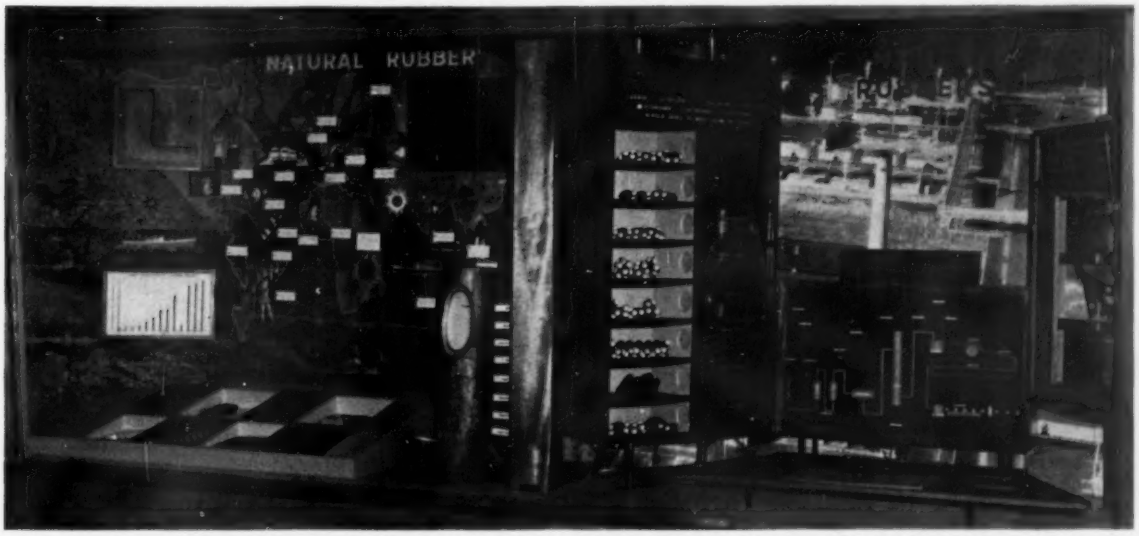
The second show case has as its main feature a mural painting brilliantly designed and coloured to illustrate the vital part which rubber plays in every phase of modern life and human achievement. In front of this are examples of rubber products in common use in everyday life. Inset at the back are three electrical units controlled by exterior push buttons, which display photographs of the more important industrial and domestic uses of rubber. Detailed drawings on the front of the stand show the many uses of rubber in a modern motor car and in a modern aeroplane.

The third showcase is devoted to the production of natural and synthetic rubber. In the natural rubber section, lights flash one by one in chronological order across an illustrated map of the world to trace the history of rubber from the fossils of Eocene Germany and the ball games of the Aztecs, to the most modern plantations in South East Asia and Africa. There is a full-scale model of the trunk of a rubber tree to demonstrate the tapping process, and models and pictures to illustrate the new techniques of bud grafting and latex preservation as well as traditional methods of coagulating, rolling and drying smoked sheet.

In the synthetic rubber section the main feature is an illuminated flow chart showing how styrene-butadiene rubber—the general-purpose synthetic—is made. The structures of this, and of seven other synthetic rubbers are displayed in molecular models, and the use made of their special properties is illustrated in another rotating unit.

The display has been devised and organized by the Federation of British Rubber and Allied Manufacturers and

A black and white picture does not do justice to the brilliantly coloured mural in the centre showcase



Natural and synthetic rubber production, and processing and properties (above and below) are the main themes of the flanking showcases

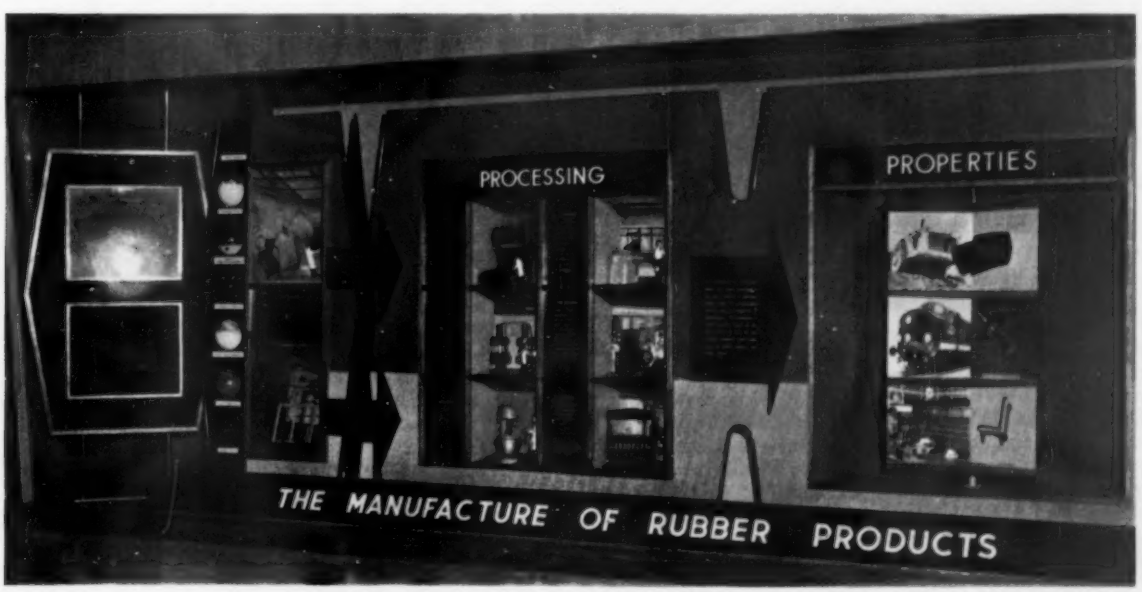
made possible by the generosity of British manufacturers of rubber products; makers of synthetic rubbers, compounding chemicals, processing machinery and components; the Natural Rubber Development Board representing producers of natural rubber; and the National College of Rubber Technology. It was designed by David Urwin and built by A. E. L. Mash and Associates. The map and the mural were painted by William Kempster and Barry Evans.

Subscribers

The following list of subscribers has been made available to us by Mr Stuart C. Covell, Director of the Federation. He took the opportunity to thank once more the firms and organizations concerned for their generosity and co-operation:

Akron Standard (Engineers) Ltd., J. Allen Rubber Co. Ltd., Anchor Chemical Company Ltd., Andre Rubber Co. Ltd., George Angus and Co. Ltd., Armstrong Cork Company Ltd., C. Atkinson (Tyres) Ltd., The Avon India Rubber Company Ltd., Bank Bridge Rubber Co. Ltd., B.B. Chemical Co. Ltd., Belpar Rubber Company Ltd., Bergougnan Tyre Co. Ltd., Boro Rubber Co. (1912) Ltd., David Bridge & Co. Ltd., John Bright & Brothers Ltd., Britiona Ltd., The British Bata Shoe Company Ltd., British Driver-Harris Co. Ltd., British Enka Ltd., British Geon Ltd., B.T.R. Industries Ltd., Cabot Carbon Ltd., The Cannon Rubber Manufacturers Ltd., Caswell & Co. Ltd., Clifford Covering Company Ltd., Henry A. Cole & Co. Ltd., Columbian-General Blacks Ltd., Columbian International (Great Britain) Ltd., The County Chemical Co. Ltd., Courtaulds Limited, P. B. Cow & Company Ltd., Crispin Chemical Co. Ltd., Cromer Ring Mill Ltd., Dexine Rubber Company Ltd., R. & J. Dick Ltd., Dowty Seals Ltd., Dunlop Rubber Co. Ltd., Du Pont Company (United Kingdom) Ltd., Durable Rubber Manufacturing Co. Ltd., Durham Raw Materials Ltd., Electric Hose & Rubber Co. Ltd., Empire Rubber Company & Rubber Bonders Ltd., Esso Petroleum Company Ltd., Evode Ltd., Expanded Rubber Company Ltd., J. H. Fenner & Co. Ltd., Fincham & Smith Ltd., Firestone Tyre & Rubber Co. Ltd., J. G. Franklin & Sons Ltd., Futura Rubber Co. Ltd., The Geigy Company Ltd., General Electric Co. Ltd., Golf Ball Developments Ltd., The Goodyear Tyre & Rubber Co. (Gt. Britain) Ltd., Greengate & Irwell Rubber Co. Ltd., The Harboro' Rubber Co. Ltd., Harrison Kent Ltd., Hazel Grove Rubber Co. Ltd., C. E. Heinke & Coy. Ltd., Hubron Rubber Chemicals Ltd., Hytex Ltd., Imperial

Continued on page 205



Plastics at Work

SINGLE AND TWIN SCREW EXTRUDERS ON PVC

By DAVID ALEXANDER

MENTION was made last week of the extrusion of PVC and it may be useful to compare single and twin screw extruders and their requirements in relation to different grades of PVC.

Plasticized PVC can be processed either on single or twin screw extruders and in most cases with single screw machines a Banbury mixed material is used. Although this is also the case with twin screw machines there is now a development of the use of dry blended mix due to the high gear working permitted by the two screws. On the single screw machine using granule a screw of 12 to 1 ratio length/diameter ratio, and a 2 to 1 compression ratio is technically permissible. However, due to the expanding market for extruded products the tendency is to lengthen screws and to increase the compression ratio calling for a closer control of temperature both in the barrel and the screw.

Alternatively when a dry mix is used on a single screw machine the material needs more working and therefore a screw ratio of 18 to 1 or even higher is advisable and also a compression ratio of between 3 and 4. Again the design of the screw with a plasticized dry mix calls for less clearance in order to ensure complete homogeneity of the mix prior to extrusion, also it is advisable to use a finer screen than would be used for granule.

Plasticized PVC filament can, of course, be extruded either horizontally or vertically. However, the less plasticizer there is in the compound the more advisable it is to extrude horizontally.

Unplasticized PVC

As was previously mentioned unplasticized PVC is not an easy material to extrude and the operating temperature is very limited as the extrusion temperature for unplasticized PVC is very much closer to its decomposition point than with plasticized PVC. Another problem with unplasticized PVC is the very much faster frictional heat build-up that takes place plus the fact that it has a poorer heat transfer property than plasticized PVC. In these circumstances it is advisable to more heavily stabilize unplasticized PVC and lubricate. However, with the development of the new applications for this material the use of unplasticized PVC is very limited and therefore in examining single or twin screw extruders it is as well to work on the basis of a very low stabilizer content, no plasticizer at all.

Lubricant Reduced

Originally it was felt that up to 4% of lubricant was essential in order to extrude unplasticized PVC satisfactorily but today this percentage figure has been successfully reduced. Unplasticized PVC can, of course, be extruded on either single or twin screw extruders and in both cases until fairly recent times these extrusions took place from granules. The idea of extruding from a dry mix was not considered satisfactory as the physical properties of the end product may or may not be consistently the same. The process of a Banbury mix followed by extrusion was felt to give the best quality end product. However, regardless of the type of machine the important feature is the stock temperature. Obviously the operating temperature varies according to the type of unplasticized PVC compound used and this can vary from between 330 to over 400°F., but the operating range for the particular compound will not vary more than 10°F. either way. The extrusion temperature would be the same regardless of the type of machine used.

It is here, however, that the problem of machine selection commences as the screw design and the means of controlling barrel temperature must vary from machine to machine. In the extrusion of unplasticized PVC the trend in Europe and the United States has for a long time been towards the use of twin screw extruders and already in the UK this trend has developed to a considerable extent. There seems to be a particularly good case for the use of a twin screw machine such as the Windsor, Trudex, Mapre or Alpina with unplasticized PVC. In this twin screw process the stock temperature is normally controlled by the screw speed and the rate of feed. In these circumstances it is possible to maintain very similar extrusion conditions for long periods. Also one great advantage of the twin screw process for unplasticized PVC is that through the more positive movement of the screws much of the pulsation which can arise with unplasticized PVC, particularly where there is a variation in the feed conditions on single screw machines, is eliminated.

If, however, unplasticized PVC is to be extruded by single screw method, a length/diameter ratio of up to 20 to 1 is advisable and in certain designs of single screws it is also recommended when processing unplasticized PVC that they be fitted with some means of circulating heat such as steam or oil.

In selecting new machines the plastics engineer has many variables to contend with and in particular when switching from single screws to twin screws a re-orientation of ideas on extrusion is necessary. For example, in the single screw machine the compound is worked more or less progressively through the barrel to the die whereas on the twin screw the great bulk of the work is done in the last 25% of the screws. It is therefore probable that first experiences on twin screw machines, particularly on a new design, can lead to much difficulty and misunderstanding with unplasticized PVC in many cases; single screw designed die-heads have been subsequently fitted to twin screw extruders with very disappointing results, resulting in the condemnation at an early period of good machines.

Single or Twin

This would seem particularly to be likely to arise in Britain where views are still very much divided on single or twin screw machinery. The size of die-head used on the single screw extruder is sometimes by comparison very large and long compared with the length of die-head required for the twin screw machine. If such a die is fitted to a twin screw then the machine must be operated slowly in order to produce, for instance, satisfactory tube. In fact, whenever a speed-up in production is attempted, this large head causes a build-up of temperature and within a short period of time a burn-up takes place. It is therefore essential to design die-heads specifically for twin screw machines as only by doing this can trouble-free high output be achieved. This point cannot be stressed too much as it is

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probably the most important single feature in making the twin screw extruder more satisfactory than the single screw extruder on the large output of unplasticized PVC.

The effect of different types of die design can be seen clearly enough. Let us take three examples, A, B, and C. In each case the machines used are Windsor RC 100s and the material being run is polythene tubing to the 1972 specification, which by any standard is an easy product to extrude. Each of the companies using these machines must have run millions of feet of this tubing and yet on the identical sizes they achieve in Case A an output of 50lb. an hour, Case B, 70lb. a hour, and Case C, 83lb. an hour. In Case A, the die design is very simple and the dies are not chromium plated. In Case B, the die design is of a more stream-lined style and the dies are chromium plated. In Case C, the inside of the dies are the same as in Case B, but the exterior of the die in various ways has been redesigned in order to effect a better temperature control.

Pre-Purchase Trials

During tests at extruder manufacturers' factories, many problems and difficulties can arise which can lead to pre-judgment and wrong judgment of the particular plant concerned. To some extent the assessment of a machine's capabilities must be made from the extruder manufacturer's own abilities to extrude particular types of plastics material. Where the particular material is well known and has been extruded for years there are normally no difficulties during demonstration. Even if difficulties do arise, in most cases the potential buyer is already aware of what the machine can do. The problems are more likely to arise with new PVCs of which there is no particular production experience.

This may well be the case with the low stabilized unplasticized PVC compound now coming on to the market for production of drinking water and gas services. Again initial difficulties can arise when the extruder manufacturer and the extruding company are of different countries. For example theoretically it must be very much easier for R. H. Windsor to sell an extruder in the United Kingdom than, say, Germany, and apart from any nationalist views there must be a wealth of experience built up with these machines operating on British resins, whereas this experience with German resins cannot be as great.

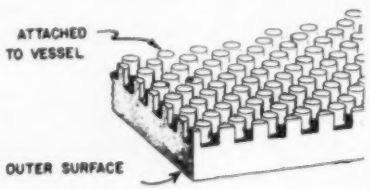
Presumably also the alternative position must arise where a Continental extruder manufacturer is selling plant in the United Kingdom. Another important factor that may be ignored by potential purchasers of plant is that in a great many cases the extrusion machine manufacturer cannot operate his own machines as effectively using particular resins as his own customers, and it would seem from experience that in most cases extrusion companies get very much greater output from the extruders than the manufacturer either expected or demonstrated during trials.

Whatever conclusions may be drawn from machine comparisons, it is as well to bear in mind at least the two main independant influencing factors, namely, die design and experience of the particular machine.

200 mph Under Water

A scientist who studied the behaviour of a school of porpoises initiated a branch of rubber research which may well make it possible to travel underwater at 200 mph.

The scientist is Dr Max O. Kramer, vice-president of Coleman-Kramer Inc., Los Angeles. Dr Kramer worked out, from its speed and weight, that a porpoise has only about one-tenth of the drag that would be expected from its size and shape. Normally an object being propelled through water actually uses from 70-90% of the propulsive energy to overcome the drag due to turbulence, which is created by the object itself.



Dr Kramer, who has worked for years on anti-turbulence research, examined a sample of porpoise skin and found that it contains a $\frac{1}{16}$in. hydraulic layer that is elastic and ducted. In 1957 his firm joined forces with US Rubber's research centre, and many compounds and designs were tried in attempts to imitate the porpoise's hydraulic layer. The most practical development so far is a thin layer of rubber supported by a multitude of tiny rubber pillars.

Inter-connecting channels between the pillars contain a freely flowing viscous liquid. The channels face the surface of the object, and the outside, or water side, of the coating is smooth. The channels give the coating flexibility, and the liquid provides the necessary damping to suppress potential turbulence.

US Rubber is experimenting with the material—called Laniflo coating—on the hulls of motor boats to determine how much effective power gain can be expected. The underwater world offers some of the most unusual possibilities. Vice-Admiral Charles B. Momsen, retired Naval submarine expert and co-developer of the Momsen lung escape apparatus, believes that submarine speeds of 60 knots (about 70 miles an hour) would be possible with the development of a successful submarine 'skin.' With further improvement in power plants, he predicts, underwater objects could travel as fast as 180 knots (about 207 miles an hour).

THIS IS US

Continued from page 203

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VIEWS *and* REVIEWS

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **Dr Schidrowitz**

Synthetic Rubber

IN continuation of my review of *The Reports on the Progress of Applied Chemistry* (Vol. XLIII, 1958), the section on synthetic rubber is discussed below.

Numerous patent specifications concerned with stereospecific polymerization reflect ever-increasing activity in the development of new synthetic rubbers, some of which have already been described in the last report. A useful review and bibliography relating to polymerization with the necessary complex metal catalysts is now available.

Further information is now to hand concerning the similarity of *cis*-polyisoprene and natural rubber. A US Government report claims that Coral and natural rubbers are equal in chemical and physical properties but that the synthetic rubber is slightly superior with respect to low-temperature resistance. Natsyn is said to have performed as well in the larger size tyres in which Ameripol-SN is claimed to produce less heat build-up. The Russian *cis*-polyisoprene SKI, appears also to be satisfactory as regards hysteresis loss and heat build-up but it is admitted to be inferior to natural rubber in tear resistance, high-temperature stability and abrasion resistance.

Polybutadienes of high *cis* configuration blend well with natural rubber in ratios 1 : 1, giving satisfactory processable mixings, which can be vulcanized to good products. Excellent hysteresis properties and 20-30% better abrasion is claimed for retread tyres with blends containing 50% of *cis*-polybutadiene of 95% *cis* content. Diene is a new polybutadiene stated to be useful for extending natural rubber so that both improved crack resistance and anti-skid behaviour can be obtained in truck tyres.

Reaction with perbenzoic acid can be used to determine relative proportions of 1 : 2 and 1 : 4 structure in these polymers and it is now shown that the degree of cross-linkage obtainable on sulphur vulcanization is directly proportional to the proportion of 1 : 4 structure.

Butyl

A new procedure for vulcanization is cross-linking with phenol-formaldehyde derivatives. Catalytic agents are required to hurry the process but tendency to reversion seems to be eliminated and the upper limit of serviceability of the product is claimed to be increased by 100°F.

Latex Preservation Systems

In 'Views and Reviews' of January 30 in reviewing Neal's 'Rubberi' in 'Reports on the Progress of Applied Chemistry,' I dwelt briefly on the trials and applications (and the reasons therefor) of the many alternative systems of latex preservation, usually based on about 0.2% of ammonia, plus a small quantity of another preservative.

There is in the current (*January 1960*) issue of our sprightly contemporary, the *Planters' Bulletin*, an article on 'Low Ammonia Latices' with the sub-title 'The Use of Boric Acid,' which brings this story of deviation from the generally accepted standard up-to-date, if I may say so, from the practical planter's point of view.

Practical Point of View

In an introductory statement it is mentioned that 'We have been much concerned in recent years in investigating alternatives for ammonia for preserving latex concentrate which continues to be one of our most valuable rubber exports. Many different chemicals have been tested which might have been expected to preserve latex, because of their bactericidal action or their ability to "neutralize" destabilizing substances, but only a few have survived the searching laboratory tests applied to NR latices destined for commercial application.' The statement continues:

'We may fairly claim that all the present low ammonia latices produced in Malaya were born in our laboratories Others are under investigation and perhaps among them there may be a preservative system which is clearly superior to all others.'

Types Made in Malaya

Five different kinds of 'low ammonia' latex concentrate are being made in commercial quantities in Malaya. These are:

1. Santobrite latex was first patented in 1938 by the Monsanto Chemical Company from work done at RRIM and by agreement with the company the Institute issued free licences to producers who wished to make use of the process: it is no longer necessary to obtain a licence and this type of process is now being made by most Malayan producers of concentrate. Sodium pentachlorophenate (Santobrite) or pentachlorphenol (Santophene) dissolved in caustic phenol, at concentrations ranging 0.1 and 0.3%, are used together with 0.2 to 0.1 of ammonia.

2. EDTA (ethylenediamine tetracetic acid) was the subject of a patent by the US Rubber Company. The acid is used at a concentration of 0.2% together with 0.2% of ammonia.

3. A patent for the use of a combination of EDTA with Santobrite and ammonia has been granted to RRIM and such combinations are in commercial use.

4. The General Latex Corporation has patented the use of zinc dialkyl dithiocarbamates, together with a soap, and the H. and C. Latex Company make a 'low ammonia' based on this system, using up to 0.1% of ZDC and about 0.2% of ammonia.

5. Boric acid preserved latex is the subject of a patent application (already granted in certain countries) by the RRIM and licences to produce this type of latex are granted free of charge to Malayan producers. The terms of this licence require that certain regular returns be made to the RRIM, and that samples of shipments be submitted for testing to provide for quality control. It was found that 0.2 to 0.25 of boric acid, 0.2 of ammonia and about 0.05% ammonium laurate soap are required to give adequate preservation and satisfactory stability.

I propose to conclude this review of the article 'Low Ammonia Latices' next week.

PHILIP SCHIDROWITZ

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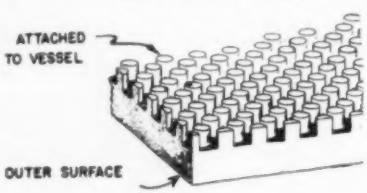

Dr Kramer, who has worked for years on anti-turbulence research, examined a sample of porpoise skin and found that it contains a $\frac{1}{10}$in. hydraulic layer that is elastic and ducted. In 1957 his firm joined forces with US Rubber's research centre, and many compounds and designs were tried in attempts to imitate the porpoise's hydraulic layer. The most practical development so far is a thin layer of rubber supported by a multitude of tiny rubber pillars.

Inter-connecting channels between the pillars contain a freely flowing viscous liquid. The channels face the surface of the object, and the outside, or water side, of the coating is smooth. The channels give the coating flexibility, and the liquid provides the necessary damping to suppress potential turbulence.

US Rubber is experimenting with the material—called Laniflo coating—on the hulls of motor boats to determine how much effective power gain can be expected. The underwater world offers some of the most unusual possibilities. Vice-Admiral Charles B. Momsen, retired Naval submarine expert and co-developer of the Momsen lung escape apparatus, believes that submarine speeds of 60 knots (about 70 miles an hour) would be possible with the development of a successful submarine 'skin.' With further improvement in power plants, he predicts, underwater objects could travel as fast as 180 knots (about 207 miles an hour).

THIS IS US

Continued from page 203

Chemical Industries Ltd., J. G. Ingram & Son Ltd., The International Synthetic Rubber Company Ltd., Ioco Ltd., I.T.S. Rubber Ltd., Kautex Ltd., Sam Kay Rubber Co. Ltd., Leyland & Birmingham Rubber Co. Ltd., Lintafoam Industries Ltd., London Rubber Company Ltd., Long & Hambly Ltd., Joseph Lucas (Electrical) Ltd., George MacLellan and Company Ltd., J. Mandleberg & Co. Ltd., Micafine Ltd., Michelin Tyre Co. Ltd., Monsanto Chemicals Ltd., David Moseley & Sons Ltd., Murray & Ramsden Ltd., National College of Rubber Technology, The National Standard Company Ltd., The Natural Rubber Development Board, Newfeld Ltd., The North British Rubber Co. Ltd., The Northern Rubber Co. Ltd., Northwestern Rubber Co. Ltd., Paramat Ltd., Philblack Ltd., Phillips Rubber Soles Ltd., Pirelli Ltd., Plus Products Ltd., Polymer (United Kingdom) Ltd., Poppe Rubber & Tyre Co. Ltd., Pussyfoot Products, Redferns' Rubber Works Ltd., The Rubber Company of Scotland Ltd., Rubber Improvement Ltd., Rubber Latex Ltd., The Rubber Regenerating Co. Ltd., The Rubber Trades Association of London, Rubberware Ltd., Runnymede Rubber Company Ltd., St. Helens Cable & Rubber Co. Ltd., Francis Shaw & Co. Ltd., Shell Chemical Company Ltd., The Sherborne Rubber Co. Ltd., Ship Carbon Company of Gt. Britain Ltd., Silent Channel Company Ltd., Wilfrid Smith Ltd., Stalybridge Rubber Co. Ltd., Surridge's Patents Ltd., The Sutcliffe Moulded Rubber Co. Ltd., W. A. Thatcher Ltd., Luke Turner & Co. Ltd., Turner Brothers Asbestos Co. Ltd., United Carbon Black Ltd., U.S. Rubber International (Great Britain) Ltd., United Kingdom Chemicals Ltd., Veedip Ltd., Vik Supplies Ltd., Vitafoam Ltd., Volcrete Ltd., James Walker & Co. Ltd., Waltham Rubber & Plastics Ltd., William Warne & Co. Ltd., Waterside Mill Co. (Bury) Ltd., Witco Chemical Company Ltd., R. Woolf & Co. (Rubber) Ltd.

VIEWS *and* REVIEWS

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **Dr Schidrowitz**

Synthetic Rubber

IN continuation of my review of *The Reports on the Progress of Applied Chemistry* (Vol. XLIII, 1958), the section on synthetic rubber is discussed below.

Numerous patent specifications concerned with stereospecific polymerization reflect ever-increasing activity in the development of new synthetic rubbers, some of which have already been described in the last report. A useful review and bibliography relating to polymerization with the necessary complex metal catalysts is now available.

Further information is now to hand concerning the similarity of *cis*-polyisoprene and natural rubber. A US Government report claims that Coral and natural rubbers are equal in chemical and physical properties but that the synthetic rubber is slightly superior with respect to low-temperature resistance. Natsyn is said to have performed as well in the larger size tyres in which Ameripol-SN is claimed to produce less heat build-up. The Russian *cis*-polyisoprene SKI, appears also to be satisfactory as regards hysteresis loss and heat build-up but it is admitted to be inferior to natural rubber in tear resistance, high-temperature stability and abrasion resistance.

Polybutadienes of high *cis* configuration blend well with natural rubber in ratios 1:1, giving satisfactory processable mixings, which can be vulcanized to good products. Excellent hysteresis properties and 20-30% better abrasion is claimed for retread tyres with blends containing 50% of *cis*-polybutadiene of 95% *cis* content. Diene is a new polybutadiene stated to be useful for extending natural rubber so that both improved crack resistance and anti-skid behaviour can be obtained in truck tyres.

Reaction with perbenzoic acid can be used to determine relative proportions of 1:2 and 1:4 structure in these polymers and it is now shown that the degree of cross-linkage obtainable on sulphur vulcanization is directly proportional to the proportion of 1:4 structure.

Butyl

A new procedure for vulcanization is cross-linking with phenol-formaldehyde derivatives. Catalytic agents are required to hurry the process but tendency to reversion seems to be eliminated and the upper limit of serviceability of the product is claimed to be increased by 100°F.

Latex Preservation Systems

In 'Views and Reviews' of January 30 in reviewing Neal's 'Rubberi' in 'Reports on the Progress of Applied Chemistry,' I dwelt briefly on the trials and applications (and the reasons therefor) of the many alternative systems of latex preservation, usually based on about 0.2% of ammonia, plus a small quantity of another preservative.

There is in the current (*January 1960*) issue of our sprightly contemporary, the *Planters' Bulletin*, an article on 'Low Ammonia Latices' with the sub-title 'The Use of Boric Acid,' which brings this story of deviation from the generally accepted standard up-to-date, if I may say so, from the practical planter's point of view.

Practical Point of View

In an introductory statement it is mentioned that 'We have been much concerned in recent years in investigating alternatives for ammonia for preserving latex concentrate which continues to be one of our most valuable rubber exports. Many different chemicals have been tested which might have been expected to preserve latex, because of their bactericidal action or their ability to "neutralize" destabilizing substances, but only a few have survived the searching laboratory tests applied to NR latices destined for commercial application.' The statement continues:

'We may fairly claim that all the present low ammonia latices produced in Malaya were born in our laboratories Others are under investigation and perhaps among them there may be a preservative system which is clearly superior to all others.'

Types Made in Malaya

Five different kinds of 'low ammonia' latex concentrate are being made in commercial quantities in Malaya. These are:

1. Santobrite latex was first patented in 1938 by the Monsanto Chemical Company from work done at RRIM and by agreement with the company the Institute issued free licences to producers who wished to make use of the process: it is no longer necessary to obtain a licence and this type of process is now being made by most Malayan producers of concentrate. Sodium pentachlorophenate (Santobrite) or pentachlorphenol (Santophene) dissolved in caustic phenol, at concentrations ranging 0.1 and 0.3%, are used together with 0.2 to 0.1 of ammonia.
2. EDTA (ethylenediamine tetracetic acid) was the subject of a patent by the US Rubber Company. The acid is used at a concentration of 0.2% together with 0.2% of ammonia.
3. A patent for the use of a combination of EDTA with Santobrite and ammonia has been granted to RRIM and such combinations are in commercial use.
4. The General Latex Corporation has patented the use of zinc dialkyl dithiocarbamates, together with a soap, and the H. and C. Latex Company make a 'low ammonia' based on this system, using up to 0.1% of ZDC and about 0.2% of ammonia.
5. Boric acid preserved latex is the subject of a patent application (already granted in certain countries) by the RRIM and licences to produce this type of latex are granted free of charge to Malayan producers. The terms of this licence require that certain regular returns be made to the RRIM, and that samples of shipments be submitted for testing to provide for quality control. It was found that 0.2 to 0.25 of boric acid, 0.2 of ammonia and about 0.05% ammonium laurate soap are required to give adequate preservation and satisfactory stability.

I propose to conclude this review of the article 'Low Ammonia Latices' next week.

PHILIP SCHIDROWITZ

MEN *and* MATTERS

A Review of People and Events

by George A. Greenwood

THEY surely are making an awful lot of plastics in Wales these days, man! An interesting contribution by Dr R. A. Gregory to the *Western Mail Commercial and Industrial Review* for 1960, shows what a firm foothold plastics materials have now got in the Principality. Dr Gregory, who is joint managing director of Midland Silicones Ltd., points out that plants, concentrated mainly around Barry and Newport, now turn out more than one-seventh of all the plastics materials produced in Britain. 'And,' he adds, 'they are making a handsome contribution to the new prosperity of the area.'

As I have indicated, nearly all of them have been built since the war, and the factory at Barry belonging to Dr Gregory's company, is now the largest silicone-producing plant in Europe. Dr Gregory adds that when it was commissioned, in 1954, it was widely regarded as a model of automation in the chemical industry. Since then improvements have been made to the complex processing equipment used, much additional plant has been installed and new buildings have been put up. Work started on the pilot plant in 1957 has recently been finished at a cost of about £250,000. In the meantime, of course, the big building for the production of silicone rubbers had been completed in 1958, and so progress has continued. Dr Gregory adds that the two silicone factories in Britain—the one at Barry and the other at Ardeer in Scotland—now not only produce sufficient silicone products for the entire home market but make considerable amounts for export.

Trans-Continental Retreads

The £10,000 Trans-Continental coach featured on television recently was fitted with 'Blue Peter' retreads before it made its inaugural journey with 30 passengers, through France, Switzerland and Italy en route for Israel. I understand that the trip was a great success. The owner, Mr Lipsey, who runs a fleet of London taxis, now plans regular trips to Israel which will in future run via Turkey and Syria. In addition, the 'retreaded' coach is to take parties to the Passion Play at Oberammergau, and the Olympic Games in Rome. The coach, which is fully air conditioned, is equipped with coffee bar, kitchen, cocktail bar, and library.

Automation in Industry

Both rubber and plastics industries will have a positive interest in the exhibition of automatic industrial inspection equipment, which is to open in London on March 14, and to continue until July 31. It is being held by Production-Engineering Ltd., a leading management - consultancy company, and will be the first of its kind in Britain. It is taking place in collaboration with leading companies in the field of electronics and automation, all of whom will be exhibiting—at 12 Grosvenor Place, Victoria—where the show is being arranged.

The exhibitors include Mullard Equipment Ltd. (shape recognition); Teddington Industrial Controls Ltd. (dimensional inspection); Baldwin Instrument Co. Ltd. (thickness measurement); Industrial Products (Speco) Ltd. (automatic check-weighing); Research and Control Instruments Ltd. (vibration measurement); Pye Ltd. (industrial television); Racal Engineering Ltd. (counting); Venner Ltd. (time measurement).

Yorkshire Tykes to Plastics

Bradford has been a little agitated recently. The question arose whether the council should buy, for school meals, heavy-duty pottery or plastics plates. After long arguments the council came out in favour of pottery—but by this time the Education Committee had acted on its own and bought plastics plates. As these proved satisfactory, this *fait accompli* settled the argument. Incidentally, one of the things that influenced the Education Committee in their choice was that the canteen staff threatened to strike unless plastics plates were used. They said that plastics meant no breakages—and no cuts.

Peter J. Garner, who became chief accountant of the P. B. Cow Group on January 1 (*RJIP* **Dec. 26.**)

Here and There

One of the four speakers at a conference on 'Training the Apprentice,' which is being organized by the Training-Within-Industry Association at Caxton Hall, Westminster, on Thursday of next week (February 11), will be Mr A. R. Essex, who is in charge of training at E. K. Cole Ltd. His subject will be the improving of training between craftsman and apprentice. The conference will be attended by members of the Association from London and the South-East.

Polypotted Cheese

There's a newcomer to the cleverly named range of polypots produced by Metal Box Plastics. Called 'Polypot 36,' it is tub-shaped and made of high impact polystyrene, and can be printed in two colours; brimful it holds just over 3½ fluid ozs.

Metal Box tell me that, like Pooh's, it's a very useful pot; cheese and various spreads and extracts can be packed into it, as well as chemical products such as cosmetic creams.

Unaccustomed As I am . . .

I hear that Mr G. R. ('Roy') Watson, Advertising Manager of the Goodyear Tyre and Rubber Co. (Gt. Britain) Ltd., has recently been elected President of the Wolverhampton Toastmasters Club. This comparatively new organization is based on Toastmasters International Santa Ana, California.

A Toastmasters Club is a group of men who try to improve their public speaking and chairmanship. The ideas behind such a club are: to help its members to master the difficult art of public speaking; to teach them to appear effectively before any audience; to train them for chairmanship of meetings of all kinds; to encourage them to listen appreciatively to others, and to bring them into friendly and helpful contact with men in other occupations.

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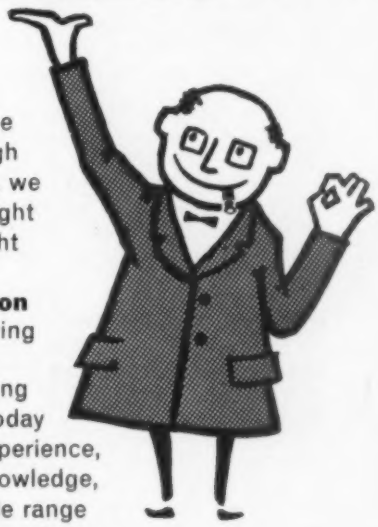

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tion and experience in control and conduct of meetings.

At present, I understand, there are not many clubs in the Midland area. The Wolverhampton Club was formed nine months ago and Roy Watson's election as President took place this month for a term of one year.

Bigger Still

Quite a lot of people, especially all those who foot-slogged conscientiously over the whole enormous area, will be interested to know that two new buildings are to be added to the exhibition site in Düsseldorf where the successful 'Kunststoffe 59' was held. One will be able to seat about 1,000 people and can be used as a restaurant, the other will be the new 'Hall D' of some 200,000 sq. ft. floor area. The additions will mean that more than 600,000 sq. ft. of exhibition area can be reached without going outside 'into the weather.' In my opinion we could do with a place on these lines in the centre of London.

Happy Birthday

Congratulations to David Bridge, who will be 80 on February 21. Mr Bridge, son of the founder of David Bridge and Co. Ltd., was formerly a director and chairman of the firm. I am glad to hear that he continues to enjoy good health.

She Walks on Plastic

Dr Barbara Moore, due to finish her marathon walk as *RJIP* goes to press this week, has had part of the way eased for her by a pair of plastic socks. These were presented to her near Kidderminster by John Chamberlin, of J. Chamberlin Ltd., the Gloucester firm, to help her on the last stage of her walk.

The firm told me that these socks —called Aries—are of the type supplied to Everest climbers, and are made up of several layers of Tygan woven monofilament (polyvinylidene chloride, extruded in this country by B.X. Plastics).

Plastics and Horn Carvers

Mr H. W. Graesser-Thomas, a pioneer of the plastics industry in Britain and a former chairman of the British Plastics Federation, was this week elected Master of the Worshipful Company of Horners, one of the oldest City Guilds. It has traditions dating back to 1284.

I understand that this Guild originally protected the interests of medieval horn carvers; as several members of the plastics industry have been admitted to it, perhaps this is an acknowledgment that plastics is a craft as well as a science.

Norman J. LeCompte has been appointed sales manager of waterproof protective clothing at US Rubber Co. He succeeded Virgil A. Wibbelsman, who retired after 40 years' service with the company.

NEW SYNTHETIC RUBBERS

COMMERCIAL PRODUCTION

GOODRICH - GULF Chemicals Incorporated announced on February 1 that advanced engineering work is under way toward the commercial production of two synthetic rubbers, Ameripol SN rubber (polyisoprene)—discovered by the company in 1954—and Ameripol CB (cis-poly-butadiene) rubber, an even more recent development.

Mr Lucien O. Crockett, the company's president, said an initial commercial plant with an annual capacity of about 25,000 tons was anticipated. He added that the company was hopeful that the plant would be in operation by late 1961. Plant sites now under consideration include two currently owned locations in Orange County, Texas, and Institute West, Virginia. It is anticipated that both these rubbers would be produced interchangeably in the same commercial plant.

MacroPlastic 1960

The number of applications for stands at the International Plastics Exhibition 'MacroPlastic 1960' at Utrecht, Holland (from October 19-26 1960 at the Croeselaan exhibition grounds) has made it necessary to reserve two further halls apart from the three halls originally planned.

The plastics exhibition will now occupy over 404,000 sq. ft. of hall space, excluding those parts of the grounds in the open air which will be in use as well.

Control has been removed from more dollar imports, including synthetic rubber, as from February 1. This was announced by Mr. Maudling, President of the Board of Trade.

Question Corner—103

(Second Series)

428. What is vinyl toluene?

(Answer next week)

Answer to Question Corner—102

427. The most common method for compensating for roll flexure in calenders is in the use of crowned, or cambered, rolls where the diameter of the roll in the centre is slightly greater than the diameter at the ends.

Recently it has been the practice to use rolls with a fixed crown and to alter the operating conditions where adjustment is required. If it is desired to increase the load on the rolls then an increase in speed, a decrease in temperature or a decrease in plasticizer content may be tried, and *vice versa*.

Another method for decreasing the load is to use a relatively larger nip opening and stretch the sheet so as to obtain the required thickness.

Roll crossing is the practice of slightly rotating the axis of one roll in the horizontal plane which increases the nip opening at the ends of the rolls relative to that at the centre, thus giving the effect of an increasing roll crown.

Roll bending is the technique of applying a bending movement at the end of each roll which subtracts from, or adds to, the deflection arising from the separating forces. It is effected with a second bearing on each roll neck, loaded with a hydraulic cylinder. This feature is relatively simple to install on existing calenders.

(Another question next week)

Polly Ester Says . . .

'Embossing—our chairman in action'

Mutual Solubility of Polymers*

MECHANICO-CHEMICAL BLENDING

IT is well-known that mixtures of polymers may be produced in various ways. These may conveniently be divided into two main groups. First there are mixtures where no chemical change takes place. In essence, these are either true solutions of a polymer in a polymer, or microheterogeneous systems; they have already been considered in detail[1-5]. (Papers by Alekseenko and his co-workers contain an erroneous proposition of a decisive part played by the polarity of polymers in their compatibility. From the theory developed by one of the present authors[1-5], mutual solubility is determined by the thermal effect of mixing, which depends only partly on the polarity of the polymers involved).

The second group of mixtures of polymers is produced with simultaneous structural alteration. With intensive mechanical action long chains are split up into macromolecules[11-15] which combine one with another or initiate the polymerization of monomeric compounds, if these are present. A striking example of this group is that of block polymers and graft polymers produced by mechanical means[16-20].

The recently discovered phenomenon of chemical flow[21-3] is directly connected with the possibility of producing a mixture of the second type—even from polymers which are spatially cross-linked initially.

Thus a mixture of two polymers may be produced in at least three different forms: a true solution of a polymer in a polymer, a microheterogeneous mixture of various types of chain molecules (compatibility without mutual solubility) and a mechanochemically modified mixture of chain molecules (block copolymers). The dependence of the properties of the first two on the composition and structure of the mixed polymers has been investigated, but little work has been done on the dependence of the properties of mechanochemical mixtures on the composition of the original polymers and the processing routine. This investigation aims to establish the basic data in this field.

*By G. L. Slonimskii and E. V. Reztsova (Vysokomol. Soed., 1959, **1** (2), 534-538). *Adapted from Translation No. 781 prepared by the Research Association of British Rubber Manufacturers.*

Objects and Method

Mixtures of butadiene rubber (SKB) with butadiene-styrene rubber (SKS-30A) were used; since systems of this kind possess a number of anomalies, vulcanizates based on a combination of these rubbers are microheterogeneous. Since we had previously studied SKS-30 rubber, we repeated analogous investigations for mixtures of SKB, not containing antioxidants, with SKS-30A.

The raw rubbers were processed on micro-rolls (180 × 146mm, with friction 1 : 1.11), on refiner rolls (405 × 146mm, with friction 1 : 1.22), and on a special modifier (the scroll type) previously described[24]. Metal parts in contact with the polymer were well cooled with water. If the modifier was used the raw rubber was either processed in air, or in nitrogen specially freed from oxygen.

Mixtures of the raw rubbers in various proportions were prepared, and also corresponding vulcanizing stocks. The processing time varied from 5 to 6min. The resulting mixtures of raw rubbers were dissolved and the behaviour of these solutions studied.

The vulcanizing stocks were compared by two methods. Either the necessary compounding ingredients were added to the original raw rubbers and the vulcanizing stocks thus produced combined (Type I), or the appropriate compounding ingredients were added to a previously prepared mixture of raw rubbers (Type II).

The tensile strength, relative elongation and permanent set of the finished vulcanizates was determined. Also measured were the 200% and 300% moduli (*i.e.* the stresses for stretching deformations of 200% and 300%) and the fatigue strength under repeated stretching deformation (maximum deformation 100% at a frequency of 250 cycles/min. at room temperature).

Results

The dependence of mechanical properties on composition for the systems SKB with SKS-30A and SKB with SKS-30 is completely analogous, as can be seen by comparing Fig. 1b with the corresponding figure[1]. Fig. 1a shows the same dependencies for vulcanized rubbers prepared from the same stock subjected to considerably more prolonged milling during mixing.

As may be seen from the curves on Fig. 1a, b, the maxima and minima as they are placed with a proportion of 1:3 of SKS-30A and SKB hold good also for longer milling times.

Mixtures of 5% solutions of these rubbers in benzene (and also in petroleum spirit) separate into two phases. The behaviour of raw SKS-30A rubber does not differ from that of SKS-30; all the conclusions previously drawn[1-4] about the mutual solubility of SKS-30 and SKB are true for systems of SKS-30A and SKB.

Since impurities in commercial rubbers might have an inhibiting influence, analagous experiments with purer rubbers were carried out—particularly with SKS-30A which had not undergone prior thermoplasticization, and with SKB which was free from anti-agers and stabilizers.

It will be seen that the general character of such rubbers is maintained. On the graphs there is, in general, a slight alteration in the positions of the maxima and minima, and also a certain smoothing out of them (particularly with more prolonged and heavier mechanical action, for instance on refiner rolls).

Experiments were made with the mixing of these same rubbers under still more severe conditions of mechanical treatment and in the absence of oxygen. This was effected on the scroll type machine, in an atmosphere of pure nitrogen. The results, shown in Fig. 1c, d, for vulcanizates from Type I and II mixes clearly show a considerable reduction in the anomalies in the dependencies of the mechanical properties under composition.

The processing of commercial raw SKS-30A and SKB rubbers under the same heavier conditions, and in the absence of oxygen, does not eliminate the characteristic maxima and minima of the dependencies of properties upon composition.

Assessment of Results

The data presented above show that microheterogeneous mixtures of polymers produced by processing together raw SKS-30A and SKB

rubbers may under definite conditions be homogenised. Elimination of the possibility of inhibition of free radicals requires very pure raw rubbers, and isolation of the mixture from oxygen contained either in the surrounding air or in the mixture itself (in a dissolved or occluded state). Unfortunately very pure rubbers, free from stabilizers, antioxidants and anti-fatigue agents are chemically unstable and thus have an undetermined initial structure. For just this reason we used systems which were not fully purified.

The results demonstrate that a reduction in the content of inhibitor has a perceptible influence upon the character of mixtures formed from two mutually insoluble polymers. In the process of mixing two polymers there occurs not only a mixing of the chain molecules but also mechanical scission, with the formation of free radicals, which interact among themselves. The number of scissions of chain molecules depends upon the intensity of the mechanical action, while the number of combinations of radicals may vary as a function of the purity of the polymers. The processes of mixing and the mechanical production of block copolymers have a common origin. The difference is that in mixing polymers on the mill or by other mechanical means, the intensity of the mechanical action is less, while the inhibiting role of the oxygen in the air and of other admixtures is greater than in the case of mechanochemical block copolymerization, in which special methods of heavy mechanical treatment in the absence of oxygen are used together with pure polymers.

These ideas are also confirmed by the investigation of the behaviour of solutions of the resulting mixtures of raw rubbers. In all cases where the relationships (property-composition) revealed anomalies (presence of maxima or minima) the corresponding solutions separate into two phases. In the cases shown in Fig. 1c, d, where the anomalies are not great, the solutions do not separate into phases, and a considerable portion of the mixture is generally insoluble. This excludes the assumption of improved mixing in these cases, and indicates a profound chemical alteration in the structure of the actual molecules of the mixed polymers.

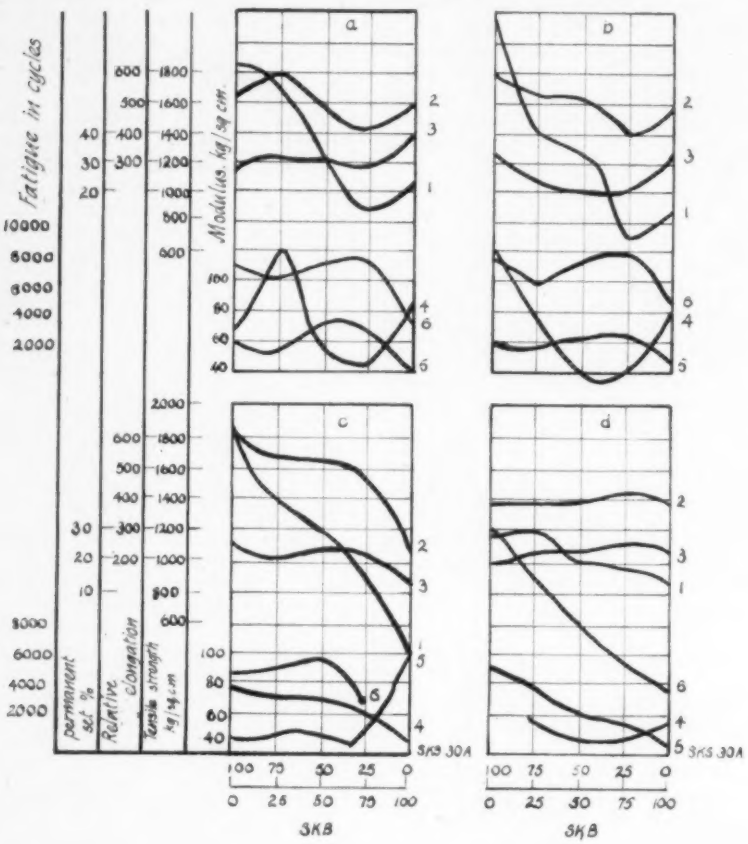

Fig. 1.—Mechanical properties of combined SKS-30A/SKB vulcanizates. a and b: for varying duration of milling on micro-rolls, in air. (a: mixture prepared 60 min.; b: 5 min.). c and d: produced by various methods on a special scroll modifier in a nitrogen medium. (a: Type I; b: Type II). 1—tensile strength. 2—relative elongation. 3—permanent set. 4—fatigue. 5—200% modulus. 6—300% modulus

Conclusions

1. In the mixing of two polymers with intermixing of molecules, which, depending on the mutual solubility or insolubility, may lead to homogeneous or to microheterogenous systems, there takes place also a mechanochemical mixing consisting of the formation of graft and block copolymers.

2. The proportion of these mixing processes is determined by the intensity and duration of the mechanical action, and also by the concentration of admixtures capable of inhibiting the free radicals formed. Of particular importance are stabilizers, antioxidants, oxygen and other such additives.

3. The anomalies previously observed in the dependence of the mechanical properties of the vulcanized rubbers based on a combination of two mutually insoluble raw rubbers may be reduced by increasing the part played by the mechanochemical mixing. This opens up ways of producing high-quality mixtures of mutually insoluble polymers.

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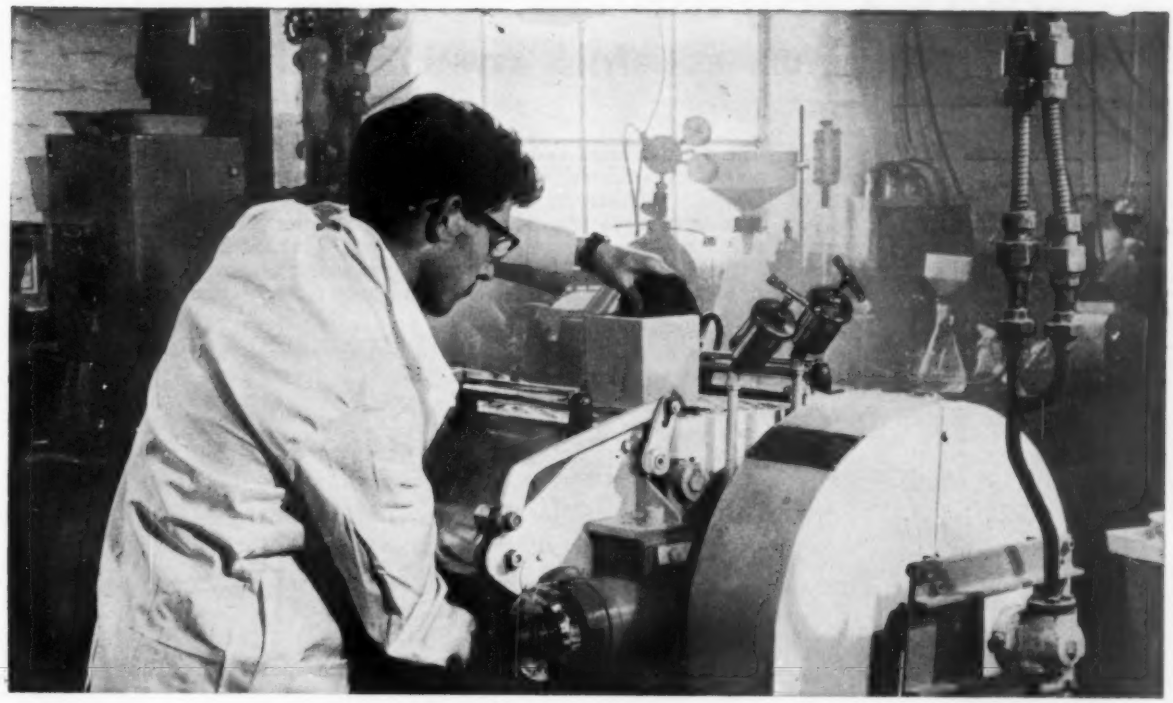
* Translation available from RABRM library.



Tests prove excellent reinforcing value of Alusil* and Microcal† in rubber

Impressive results have been obtained from continual scientific evaluation of Alusil and Microcal—proving that these fillers confer excellent reinforcing characteristics on a wide range of rubber end products.

HARDNESS. Hardness values of 93° to 97° B.S. have been recorded on resin-rubber incorporating Microcal or Alusil.

CUT GROWTH RESISTANCE. Resin-rubber incorporating Alusil or Microcal resists more than 2,000 kilocycles (to 8mm. cut) when subjected to cut growth test using the Hall flexing machine.

TENSILE STRENGTH. Alusil or Microcal give tensile strength values exceeding 1,500 p.s.i. in resin rubber compounds and over 3,000 p.s.i. in natural rubber.

TEAR STRENGTH. Using Alusil or Microcal, resin rubber tear strengths of 600–700 p.s.i. or, in natural rubber, 1,200–1,700 p.s.i. are obtained.

COLOUR CHARACTERISTICS. These Crosfield White Reinforcing Fillers give whiter stock, permitting maximum benefit to be obtained from pigments of any hue.

SET PROPERTIES. Alusil or Microcal filled stock exhibits good compression and tensile set.

A Crosfield silicate filler might well benefit *your* product or process. We have published four Progress Reports which help to bridge the gap between technical appreciation and industrial application. These Reports, together with working samples, will freely be sent on request.

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No. 1 Comparative testing *calcium* silicates in rubber compounds (natural and resin-rubber).

No. 2 Comparative testing of *aluminium* silicates in rubber compounds (natural and resin rubber).

No. 3 Microcal in Natural Rubber Compounds.

No. 4 Microcal in Resin-Rubber Compounds.

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*Aluminium Silicate. Reg. trade mark. †Calcium Silicate. Reg. Trade Mark.

CHL 24-7256-180

More Plst./Rbr. in 1960 Dr. Rm.

FURNITURE EXHIBITION AT EARLS COURT

AT an exhibition one expects to see new things on display, or at least fairly new things displayed exceedingly well. But a majority of the stands at the Furniture Exhibition, Earls Court, which closes today, fulfilled neither of these expectations. There were still aisles and aisles of stands stuffed with self-consciously angular and bulbous 'contemporary' and reproduction furniture. But in this domestic market worth £120m. a year—the industry claims to produce a chair every second of the working day—there was some break-through of good, forward-looking designs, and it was good to see that rubber and plastics were well featured in these exhibits.

Fig. 1. Glass-fibre swivel chair designed and made by Aidron Duckworth, Des.RCA. Upholstered in latex foam and a nylon-woollen fabric

The new series of easy chairs by US designer Charles Eames, for example, were upholstered in Naugahyde PVC and swivelled on a cast-aluminium, nylon-footed column base (Fig. 3). They are manufactured in the UK by Hille of London, who emphasize that because of the PVC upholstery they can be used as lounge or garden furniture.

Soothing on the eye as well as the body was the glass fibre chair designed and made by Aidron Duckworth of Kew (Fig. 1). Duckworth chose latex foam and a nylon-woollen fabric for the upholstery.

Generally, this year there was an increased use of melamine facing for doors and drawers and all decorative surfaces. In fact, from this exhibition, the blending of wood and metal with plastics seems likely to develop even more quickly in the future. Laminica of Liverpool were one firm who showed 24 standard patterns, which included six wood prints.

Furnishing firms seemed evenly divided in their preference for either latex or plastics foam, and the foam manufacturers themselves were well represented. Dunlopillo's house (*RJIP*, January 23) drew a large crowd, and Aeropreen of High Wycombe had an ingenious exhibit: a scale model of the company's four-ton-an-hour foaming plant. This made polyether foam at intervals throughout the exhibition, and children carried away free samples as if it were candy floss.

Other plastics manufacturers represented included I.C.I. (Hyde) Ltd., and Formica Ltd. I.C.I.'s display included Vynair 'breathable' upholstery in a new colour range.

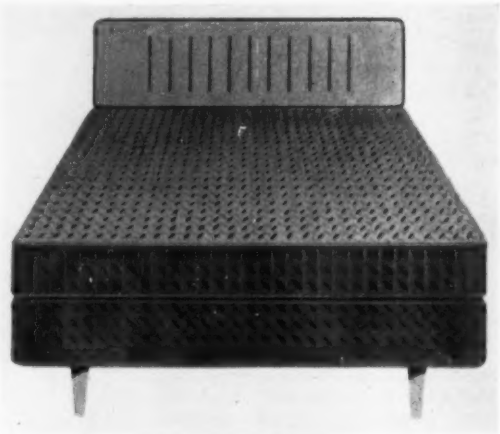

Fig. 2. New 'Silverfoam' (polyurethane) mattress of cellular construction, by Price Bros. Ltd. of Wellington, Somerset. Air can circulate freely throughout the whole mattress

Formica introduced their decorative laminate in curved surfaces.

Shortly the Boeing 707 will be delivered to BOAC. A pair of seats to be used on the aircraft were shown at the stand of the Progress Mercantile Co. Ltd. Manufactured by Microcell Ltd., the seats contain Pirelli rubber webbing.

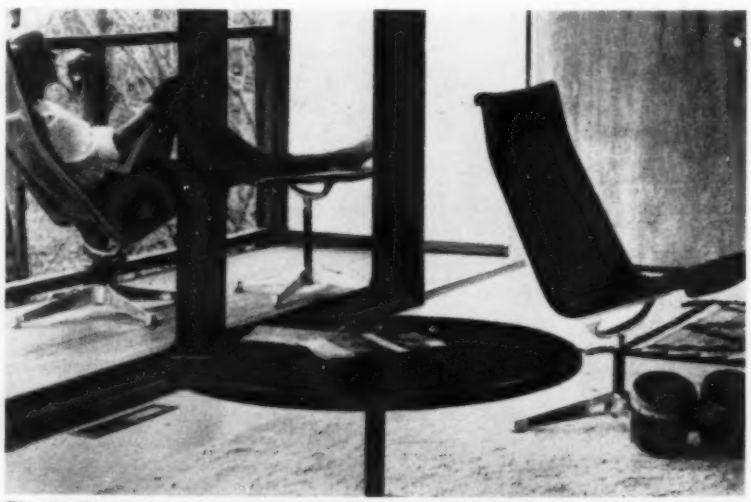

Fig. 3. The new trend in reclining chairs—by the US designer Charles Eames, now manufactured here. Chair is upholstered in Naugahyde PVC. The modern symbol, the bongos, are made of old-fashioned wood

Rubber Statistics

WORLD POSITION AT END OF NOVEMBER 1959

THE Secretariat of the International Rubber Study Group has now issued preliminary details of the world rubber position up to the end of November. The table which follows shows the natural rubber production totals for the first eleven months of the year (in 1,000 long tons):

NATURAL RUBBER

	Nov. 1959	Jan./Nov. 1959	Jan./Nov. 1958
Production ..	180.0	1,857.5	1,762.5
Consumption	185.0	1,917.5	1,795.0
		Change since	
Stocks at November 30:		Jan. 1, 1959	
In producing areas		260.0	—32.5
In consuming areas		195.0	—22.5
Afloat		232.5	+ 7.5
		687.5	—47.5

The Study Group states that the November consumption total includes estimated imports into the USSR of 26,500 tons and into China of 15,750 tons. The Group estimates that, up to the end of November, imports into these two countries had totalled 208,750 tons and 124,000 tons respectively, making 332,750 tons in all, *i.e.*, about 17% of the total amount of natural rubber consumed during these eleven months.

Stocks of natural fell during the year by 47,500 tons to 687,500 tons, which represented rather less than four months' consumption in terms of the previous twelve months' consumption figures; a year previously, nearly 4½ months' rubber was being held in stock.

Synthetic Rubber

The synthetic rubber position is set out in the following table:

SYNTHETIC RUBBER

	Nov. 1959	Jan./Nov. 1959	Jan./Nov. 1958
Production ..	150.0	1,465.0	1,120.0
Consumption..	130.0	1,425.0	1,130.0
		Change since Jan. 1, 1959	
Stocks at November 30		282.5	+25.0

US General Position

The United States Department of Commerce has issued the following preliminary statistics for the month of November (in long tons):

NATURAL RUBBER

Consumption:
42,039 tons of which latex 4,858 tons
Stocks:
80,547 tons of which latex 11,707 tons

SYNTHETIC RUBBER

	Production	Consumption	Stocks
S-Type	101,856	69,217	168,490
Butyl	7,523	5,327	11,447
Neoprene	11,660	6,684	13,043
N-Type	3,786	2,655	9,077
	124,825	83,883	202,057

The total new rubber consumption during November amounted to 125,922 tons, compared with a total of 147,643 tons during October, with natural rubber accounting for 33.38% compared with 33.22%. Total consumption to the end of November amounted to 1,494,368 tons, an increase of about 21% over the comparable 1958 total.

Vietnam

According to information released by the Study Group, Vietnam exported 19,621 tons of rubber during the last quarter of the year, bringing the year's export total to 72,273 tons; this represented an increase of nearly 5,000 tons compared with 1958. France took the largest amount of these exports, with 29,877 tons, and was followed by Western Germany which took 18,943 tons. The USA took 8,624 tons, and other countries to take smaller quantities included the UK (2,684 tons), Belgium (2,343 tons), Italy (2,750 tons), the Netherlands (2,358 tons) and Singapore (3,385 tons).

Sole Crepe

Sole crepe exports from Malaya during November amounted to 1,277 tons, and brought the total for the first eleven months of the year to 6,978 tons, or some 2,000 tons below the previous year's figure. Of the November tonnage the UK took 864 tons, while 86 tons went to Spain and 49 tons to Belgium. The USSR took 40 tons.

Sole crepe exports from Ceylon fell sharply to 51 tons in November, having amounted to 128 tons in October. This brought the total for the first eleven months of the year to 501 tons. In the case of Vietnam, crepe sole exports for the whole year amounted to 499 tons.

Book Review

RUBBER TO METAL BONDING. — S. Buchan. (London: Crosby Lockwood and Son Ltd., 2nd edn., 1959, pp. xiv, 300, 42s.)

The first edition of this book has become recognized as a standard work of reference on the bonding of rubber to metal. This second edition has been revised and considerably enlarged to include developments since the date of the first edition (1948).

The brass-plating process for bonding rubber to metal is discussed in detail and occupies slightly more than half the book. Nine chapters cover plating plant, cleaning the metal prior to brass-plating, brass-plating solutions, analysis of brass deposits and plating solutions, brass-plating procedure, processing the rubber and process control of bonding, compounding natural and synthetic rubbers for bonding, and moulds and moulding with special reference to the production of bonded units. The section on brass-plating is completed by three chapters on the physical examination of brass deposits, the chemical examination of the rubber-to-brass bond and the properties of the bond. Bonding agents including cyclized rubber, rubber derivatives containing halogens, polyisocyanates, and a variety of other materials are described in four chapters while the remainder of the book is devoted to bonding already vulcanized rubber to metal, testing bonded units, the nature of the rubber-to-metal bond and the design of bonded units.

Since the first edition of the book was published, no great advances have occurred in the brass-plating method of bonding and consequently only slight revision has been necessary in the section of the book concerned with this process. For example, reference is now included to the bonding of rubber to stainless steel by means of a modified brass-plating technique while additional natural and synthetic rubber compounds have been incorporated in the chapters on compounding for bonding. By contrast, the range of bonding agents has been considerably extended in recent years and, in the new edition, the space devoted to these materials has been increased from about 30 pages to over 80. The new matter includes a completely new section on chlorinated/hypochlorinated rubber as a bonding agent.

The author has written an authoritative work which should be read by all concerned with the bonding of rubber to metal and the reviewer endorses the remarks by Mr A. L. Freedlander, chairman of the Dayton Rubber Company, USA, in the Foreword to the book as follows: 'I believe that the world-wide rubber industry owes the author a debt of gratitude for making use of his long and intimate experience as a rubber chemist and rubber development engineer in this field in order to set down the practical engineering and chemistry of this art in detail. I have known Dr Buchan for many years and have followed his activities and know that he has the respect and admiration of rubber technologists and engineers. We feel that he has made a real contribution and hope that, as new technologies are developed in this field, he will carry on still further editions of this fine work.'—R. W. P.

∴ Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Plastic Injection Moulding Machine

No. 817,191. Crown Machine and Tool Co. Application and Filed, September 21 1956. Application in USA, September 23 1955. Published, July 29 1959.

A plastic injection moulding machine is designed to produce cups for holding liquids for use in automatic vending machines. Such cups are generally disposable and the special feature of the machine is that it will mould cups with thin and uniform walls, namely 0.010 to 0.020in. thick. The machine includes a cavity platen having a number of separate moulding cavities from which the moulded cups can be ejected in unison. Injection nozzles, one for each cavity, are arranged on a frame which also supports the cavity platen, each nozzle having a separate plastic injection unit which is supplied with plastic material from a single preplasticizer common to all the injection units.

Polymerization and Copolymerization of Butadiene

No. 817,693. The Firestone Tire and Rubber Co. Application and Filed, October 24 1956. Application in USA, November 1 1955. Published, August 6 1959.

Butadiene or mixtures of butadiene and styrene are polymerized in the presence of metallic lithium or a lithium hydrocarbon as a catalyst. The reaction may be carried out by mass polymerization or solution techniques and the polymerization temperature can range between 0°C. or lower and about 100°C. Moisture, oxygen, nitrogen and other components of air should be kept out of the reaction zone as far as possible while oxygenated and nitrogenous organic compounds should be rigorously excluded.

Examples are given of the preparation of the polymers and copolymers. They contain at least about 23% of the cis-1,4-addition product and no more than about 15% of 1,2-addition product, as determined by infra-red analysis. The vulcanized butadiene polymers and butadiene-styrene copolymers are similar in stress-strain properties to the corresponding conventional emulsion and sodium polymerized polymers and copolymers but are superior to these conventional materials in regard to performance at low temperatures, as shown by physical test results quoted in the Specification.

Synthetic Rubbery Polymers

No. 817,695. The Firestone Tire and Rubber Co. Application and Filed, October 24 1956. Application in USA, November 1 1955. Published, August 6 1959.

Isoprene is copolymerized with either styrene or butadiene in the presence of metallic lithium or a lithium hydrocarbon as a catalyst. The isoprene and styrene or butadiene may be in any proportions, although the preferred polymers contain about 30% to 95% of isoprene and correspondingly about 30% to 5% of styrene or butadiene. Important factors influencing the structure of the polymer and the speed of the reaction are as follows: Purity of the monomers and the catalyst; concentration of moisture, air and oxygen; and the temperature of the reaction. These factors are discussed.

Examples are given of the preparation of the polymers together with results of vulcanization tests in both gum and tyre tread compounds, natural rubber being included in the vulcanization tests for comparison. The polymers, particularly those containing at least 60% of isoprene, are essentially 1,4-addition products. Many of the polymers, particularly those containing not more than about 30% of styrene, exhibit when extended a fibre crystalline X-ray diagram similar to extended natural rubber. When vulcanized in either a gum stock or a carbon black stock, the polymers give tensile strengths comparable to natural rubber. Vulcanized carbon black stocks containing the polymers have low hysteresis and high modulus (comparable to similar natural rubber stocks), higher modulus than known synthetic rubbers and excellent resistance to both wear and flex-cracking.

Shorter Abstract

Graft Polymers. 819,651. Polymer Corporation Ltd. Filed, February 8 1956.—Graft polymers are made by oxygenating a preformed polymer in latex form, adding an emulsion of a monomer and then polymerizing the monomer on the oxygenated polymer.

Dunlop Fire

Damage estimated at several million pounds was caused by a fire on February 3 at the Dunlop Rubber Co.'s factory at Castleton, Rochdale. Some 40% of the 1.5m. square feet of the factory area is understood to have been affected. All five floors of the main section were seriously damaged. Dunlopillo production was not affected at this factory, said to be the largest cotton mill in the world, where the covers are put on the mattresses. Six sections, four spinning and two weaving, restarted work on Friday.

Rubber Crop Returns

Unless otherwise indicated the figures quoted, to the nearest thousand lb., represent crop returns for the month stated and for the number of months of the planting company's financial year to date. Corresponding figures are given in parentheses.

HARRISONS AND CROSFIELD

December

Castlefield.—281 (294). 6 mths—1,653 (1,410).
Golden Hope.—840 (846). 10 mths—7,404 (6,468).
Holyrood.—96 (92). 12 mths—912 (801).
Hongkong.—32 (31). 12 mths—321 (257).
Hoscote.—253 (290). 6 mths—1,436 (1,464).
Killinghall.—48 (55). 6 mths—263 (257).
Kuala Selangor.—57 (64). 12 mths—750 (609).
Kulai.—177 (242). 2 mths—346 (411).
Lanadron.—492 (499). 12 mths—5,310 (4,826).
London Asiatic.—1,767 (1,864). 12 mths—18,398 (17,122).
Malaysia.—71 (68). 12 mths—652 (667).
New Crocodile.—251 (287). 10 mths—2,349 (2,384).
Pataling.—1,503 (1,418). 2 mths—2,873 (2,523).
Prang Besar.—286 (230). 9 mths—2,281 (1,655).
Sandac.—79 (82). 9 mths—714 (665).
Sapong.—151 (162). 12 mths—1,812 (1,654).
Seaport.—80 (90). 6 mths—429 (475).
Malayalam.—915 (998). 9 mths—6,079 (5,933).
Lunuva.—144 (159). 12 mths—1,316 (1,476).
Allied Sumatra.—853 (906). 12 mths—9,085 (9,572).
Asahan.—115 (130). 5 mths—507 (624).
Bah Lias.—170 (176). 2 mths—328 (342).
Central Sumatra.—82 (93). 6 mths—425 (559).
Lankat Rubber.—87 (69). 9 mths—614 (563).
Mendaris.—216 (223). 12 mths—2,200 (2,396).
Namoe Tongan.—254 (287). 4 mths—968 (1,096).
Sialang.—240 (224). 11 mths.—2,203 (2,119).
Soengei Rampah.—54 (60). 12 mths—617 (603).
Tanah Datar.—82 (76). 12 mths—817 (918).
Tandjong.—187 (165). 6 mths—969 (908).
Toerangie.—207 (234). 2 mths—395 (445).
United Lankat.—35 (32). 12 mths—347 (368).
United Serdang.—999 (1,002). 4 mths—3,694 (3,993).

British Standards

Phenolic Moulding Materials

This revised version of BS 771 covers substantially the same ground as before, except that a further type of electrical low loss material is now included and the method of testing for water absorption is altered to conform with an international standard. For methods of test, reference is now made to the separate publication 'Methods of testing plastics' (BS 2782).

The address of the British Standards Institution Sales Branch is 2 Park Street, London, W.1.

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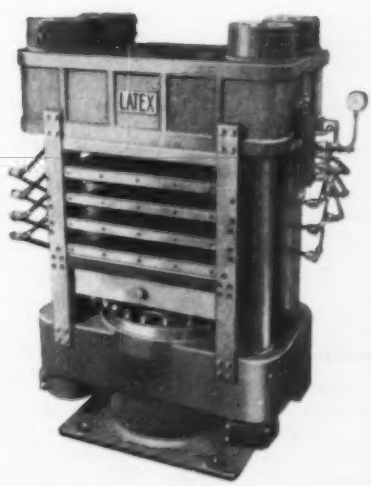
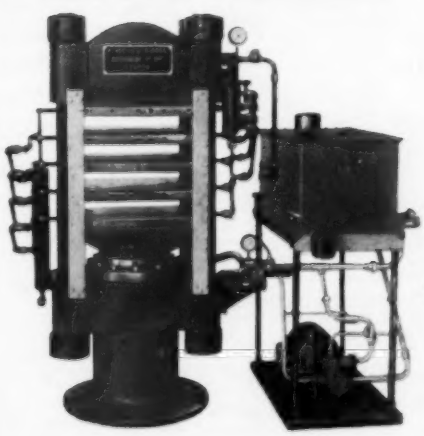


1000-ton Press



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Synthetic Rubber Prices

Prices of synthetic rubbers appear regularly in RUBBER JOURNAL AND INTERNATIONAL PLASTICS *in the first week of each month. It will be appreciated if suppliers will give notification of any price changes or additions to their range. Cif duty paid quotations are subject to slight variation due to exchange, ocean freight and insurance fluctuations. Prices are in pence per lb., except where otherwise stated.*

(e-qdp)—Ex-quay duty paid (cifUKdp)—cif UK duty paid (e-i)—Ex-installation (ddp)—Delivered duty paid (e-sUK)—Ex-store UK (ex-wUK)—Ex-warehouse UK (d)—Delivered BM—black masterbatch CBM—cold, black masterbatch CNP—cold, non-pigmented CNS—cold, non-staining COE—cold, oil extended COELC—cold, oil extended, light coloured CO/BM—cold, oil/black masterbatch CPOE—cold, pigmented, oil extended CRE—cold, rosin extended dw—Dry weight HN—high nitrile HNP—high nitrile, powder HP—hot, pigmented HS—high styrene LMW—low molecular weight MHN—medium high nitrile MLN—medium low nitrile MMW—medium molecular weight MN—medium nitrile NS—non-staining TS—total solids

SBR TYPES AND HIGH-STYRENE RUBBER

Ameripol (Goodrich Gulf) (min., 70,000-lb. lots)	(e-qdp)
1000 Hot, Non-Oil	23.10
1001 ,, ,,	23.10
1002 ,, ,,	23.34
1006 ,, ,,	23.34
1007 ,, ,,	23.34
1009 ,, ,,	23.71
1011 ,, ,,	23.71
1012 ,, ,,	23.24
1013 ,, ,,	23.94
1500 Cold, Non-Oil	23.10
1501 ,, ,,	23.10
1502 ,, ,,	23.10
1703 COE, 25% oil	*20.31
1705 ,, ,, ,,	*20.07
1707 ,, 37.5% ,,	*18.89
1708 ,, ,, ,,	*18.89
1710 ,, ,, ,,	*18.66
1712 ,, ,, ,,	*18.66

*Under 70,000 lb., min. 600 lb.

ASRC (American Synthetic Rubber Corpn.) (carloads lots of 30,000 lb.)	(cifUKdp*)
1000 Hot, Non-Oil	23.99
1001 ,, ,,	23.99
1004 ,, ,,	23.99
1006 ,, ,,	23.99
1009 ,, ,,	24.61
1018 ,, ,,	26.74
1019 ,, ,,	26.26
1500 Cold, Non-Oil	23.99
1502 ,, ,,	23.99
1503 ,, ,,	26.02
3110 ,, ,,	25.78
1703 COE	20.69
1708 ,,	19.27

*US $ conversion rate $2.80

Cariflex (Shell Chemical Company)	(e-sUK)
S-1000 Hot	22.25
S-1002 ,,	23.375
S-1006 ,,	22.25
S-1009 ,,	24.0
S-1011 ,,	24.0
S-1013 ,,	24.0
S-1100 Hot black	19.75
S-1500 Cold	22.25
S-1502 ,,	22.25
S-1509 ,,	22.25
SP-103 ,,	28.0
S-1600 Cold black	19.625
S-1602 ,, ,,	19.625
S-1605 ,, ,,	19.375
S-1703 COE	20.25
S-1707 ,,	18.0
S-1709 ,,	17.75
S-1712 ,,	17.75
S-1803 COBM	17.875

Copo (Copolymer)	(cifUKdp)
1006 Hot, Non-Oil	23.25
1500 Cold, ,,	23.25
1502 ,, ,,	23.25
1505 ,, ,,	26.00
1712 COE	18.50
1778 ,,	18.75
3900 CRE	23.125

FR-S (Firestone)	(cifUKdp*)
1000 Hot	24.10
1001 ,,	24.10
1004 ,,	24.10
1006 ,,	24.10
1007 ,,	24.10
1500 Cold	24.10
1502 ,,	24.10
146 ,,	24.10
1703 Oil-Extended	20.00
1710 ,,	18.85
1712 ,,	18.85
123 ,,	19.187
155 ,,	18.5
173 ,,	20.00
178 ,,	19.10
184 ,,	18.85
1009 Specialty	24.75
1010 ,,	26.00
1012 ,,	24.25
1013 ,,	25.00
1014 ,,	28.10
1015 ,,	28.75
141 ,,	28.625
181 Specialty	24.10
182 ,,	25.00
158 ,,	29.5

*US $ conversion rate $2.80

International Synthetic Rubber Co.	(d)
Intol 1500	22.5
Intol 1502	22.5
Intol 1006	22.5
Intol 1710	18.0
Intol 1712	18.0
Intol 1778	18.25
	(ex-wks TS)
Intol Latices R23/M23	22.25

Philprene (Phillips)	(e-qdp*)
1000 Hot, Non-Pig	23.28
1001 ,, ,,	23.28
1006 ,, ,,	23.28
1009 ,, ,,	24.69
1010 ,, ,,	25.86
1018 ,, ,,	26.80
1019 ,, ,,	26.33
1100 HP	19.65
1104 ,,	19.28
1500 CNP	23.28
1502 ,,	23.28
1503 ,,	26.10
1601 CP	19.56
1605 ,,	19.28
1703 COE	20.23
1706 ,,	19.94
1708 ,,	18.82
1712 ,,	18.58
1803 CPOE	17.78
1805 ,,	15.99

*US $ conversion rate $2.81

Plioflex (Goodyear)	(ex-wUK)
1006 HNP	22.25
1500 CNP	22.25
1502 ,,	22.25
1507 ,,	22.25
1508 ,,	22.25
1006 S	22.75
1703 COE	19.25
1710 ,,	17.75
1712 ,,	17.75
1773 COELC	19.25
1778 ,,	18.0
B—6	27.5
B—5	28.0

Polysar (Polymer UK)	(e-sUK)
S Hot	22.25
S-630 Hot	22.25
Kryflex 200 Cold	23.5
Krylene	22.25
Krylene NS	22.25
Krynol 651 COE	17.75
Krynol 652 ,,	18.0
S-X 371 Process Aid	24.0

Synpol (Texas-US Chemical Company)	(cifUKdp)
1000 Hot, Non-Oil	23.10
1001 ,, ,,	23.10
1002 ,, ,,	23.34
1006 ,, ,,	23.20
1007 ,, ,,	23.20
1009 ,, ,,	23.71
1012 ,, ,,	23.24
1061 ,, ,,	23.10
X-274	25.32
8000	23.94
1500 Cold, Non-Oil	23.10
1502 ,, ,,	23.10
1551 ,, ,,	23.10
1703 COE	20.13
1707 ,,	18.71
1708 ,,	18.71
1711 ,,	18.62
1712 ,,	18.48
8200 ,,	18.71

US $ conversion rate $2.80

SBR LATICES

Copo (Copolymer) (10-ton lots)	(cifUKdp)
2101 (dw)	46.30
X-765 ,,	40.80
X-800 ,,	37.20
2102 ,,	38.00
2105 ,,	38.00
2110 ,,	38.00

Naugatex (Naugatuck Chemical International)	(ex-wUK)
2000	39
2001	39
2002	39.5
2006	43
2105	40
2107	40
2108	40
2711	39
2714	39
2733	39
2740	43

Pliolite Rubber (Goodyear)	(d)
2000	40

Latex	
2001 (dw)	40
2104 ,,	40
2105 ,,	40
2108 ,,	40
5350 ,,	40

Pliolite Resin (Goodyear)	(d)
101A (dw)	44
150 ,,	50
151 ,,	35
160 ,,	50
170 ,,	50

Hycar (B. F. Goodrich)	(cdp)
2507 (HS) dw	48

Polysar (Polymer UK)	(e-sUK)
Latex, type IV	32.5 TS
Latex, type 722	31.75 TS
(Non-returnable 45-gallon drums)	(e-i)
Latex, type 722	28.75 TS
(bulk quantities)	

International Synthetic Rubber Co.	(ex-wks)
Intol Latex R23	22
Intol Latex M23	22

ACRYLONITRILE TYPES

Butaprene N (Firestone)	(cifUKdp)
NL	52.5
NAA	56.25
NF	51.5
NXM	60.18

Chemigum	(e-s)
N—1	75
N—3A	52
N—5	52
N—6G	45
N—7	45
N—8	45
N600X	45

Hycar (British Geon) (500-lb. lots and over)	(UKd)
1001 High Nitrile Hot	52
1041 ,, ,, Cold	52
1002 MHN Hot	45
1042 ,, Cold	45

Hycar (B. F. Goodrich) (500-lb. lots and over)	(ddp)
1411 HNP	66
1432 MHN (crumb)	64
1072 ,, (carboxyl)	66
1312 ,, (liquid)	55
1043 MLN	51
1014 Low Nitrile	61

I.C.I. (min., 5-cwt. lots)	(UKd)
Butakon A-4051 HN Cold	52
Butakon A-3051 MN Cold	45
Butakon A-3002 ,, ,,	45

Paracril (US Rubber)	(e-sUK)
18-80 Low Nitrile	63
AJ ,, ,,	50
B MLN	51
BJ ,,	51
BLT ,, Cold	51
BJLT ,, ,,	51
C MHN	59
CLT ,, Cold	59
CV ,, (crumb)	60
D High Nitrile	67
ALT	51

Polysar (Polymer UK)	(d)
Krynac 800 MN	45
Krynac 802 LN	45
Krynac 803 MN (low Mooney)	45
Krynac 801 HN	52

ACRYLONITRILE LATICES

Butaprene N (Firestone)	(cifUKdp)
N-300 (dw)	53
N-400 ,,	60.5

Chemigum Latex (Goodyear)	(d)
200 (dw)	65
235 CHS ,,	60
236 ,,	60
245 B ,,	52
245 CHS ,,	52
246 ,,	52
247 ,,	52
248 ,,	52

Hycar (B. F. Goodrich) (dry weight, drum lots)	(ddp)
1551 High Nitrile	66
1552 MHN	57

Hycar (British Geon) (dry weight, 3 drums and over)	(UKd)
1561 High Nitrile	60
1571 ,, ,, (carboxyl)	60
1562 MHN	52
1577 ,, (modified)	52

ACRYLIC TYPES

Hycar (B. F. Goodrich)	(ddp)
4021 Slab, 500 lb. and over	144
4501 Latex, dry weight	96

BUTYL TYPES

Esso	(e sUK)
Regular 035	21.75
Regular 150	21.75
Regular 215	21.75
Regular 217	21.75
Regular 218	21.75
Regular 325	21.75
Non-staining 065	22.75
Non-staining 165	22.75
Non-staining 265	22.75
Non-staining 267	22.75
Non-staining 268	22.75
Non-staining 365	22.75

Vistanex (Polyisobutylene)	(e-qdp)
MS LMW	54
MH ,,	54
L-80 MMW	54
L-100 ,,	54
L-120 ,,	54
L-140 ,,	54

Polysar (Polymer UK)	(e-sUK)
Butyl 100	21.75
Butyl 200	21.75
Butyl 300	21.75
Butyl 301 NS	21.75
Butyl 400	21.75
Butyl 101 NS	26.25
Butyl 402	22.5

Hycar (B. F. Goodrich) (500 lb. and over)	(ddp)
2202 Brominated	68

NEOPRENES

	(e-qdp)
W and WHV (dwdel)	42.62
WRT ,,	48.37
WX ,,	44.62
GN ,,	44.62
GNA ,,	44.62
GRT and S ,,	45.62
AC ,,	57.125
KNR ,,	75.62
AC 'M' and 'S' ,,	57.125
CG ,,	57.125
AD ,,	57.125

Latices—Dry (per lb. del, min., 50 lb.)	
571	49.75
842A	49.75
572	51.25
601A	51.87
650	54.125
735	51.25
736	51.25
950	58.25
60	51.87
750	51.25
635	53.62

SILICONE RUBBERS

Midland Silicones (500-lb. lots del)	
Stocks	16s. 6d. to 35s.
Pastes	26s. to 35s.
Gums and base stock	36s. to 42s.
Cold-curing silicone rubber	20s. and 23s. 6d.

I.C.I. Silicones	
Gums (40-lb. lots del)	39s. 6d.–47s.
Stocks (250 lb. lots del)	22s.–35s.
Pastes (1000 lb. lots del)	27s.6d.–35s.9d.

REINFORCING RESINS AND RUBBERS

I.C.I. (min., 2-ton lots)	(UKd)
Butakon S-8551	36.5
Butakon S-7001	33.5

Hycar (B. F. Goodrich)	(ddp)
2007 (powder)	42.5

Pliolite (Goodyear)	(d)
S—6B	36.5

Polysar (Polymer UK)	(e-sUK)
SS-250 HS (bale)	27.25
SS-250 ,, (flake)	27.5
Kryflex 252 HS	25.5

Cyclite (Durham Raw Materials)	42

HYPALON

In 50-lb. bags del UK	71.62

Rubber Markets

LONDON

The London rubber market has been very quiet indeed during the past week and prices have fluctuated narrowly. There has been little to influence the market one way or the other and interest has been at a low level. On balance, the Spot is over a ½d. lower at 35⅝d. per lb. but the forward positions are hardly changed.

Latest prices are as follows:

No. 1 RSS Spot: 35½d.-35⅝d.

Settlement House:

March 34⅛d.-34⅜d.

April/June 33¼d.-33½d.

July/September 32¼d.-32½d.

October/December 31⅜d.-31⅝d.

No. 1 RSS cif basis ports:

February 33½d.-33¾d.

March 33⅜d.-33⅝d.

Godown:

February 114¾ Straits cents nominal.

LATEX

Centrifuged latex per gallon in drums, February, March, seller 20s. 2d., April 20s., cif European ports. Spot, 20s. 8d. Bulk, 19s. 9d. Creamed, seller, February, March, 19s. 9d. Normal, seller, February, March, 15s. 6d.

AMSTERDAM

The Amsterdam rubber market ruled as follows on February 1:

	Guilders per kilo	
No. 1 RMA	Feb. 1	Prev.
February	3.31	3.31
March	3.29	3.29
January/March ..	3.24	3.29
April	3.24	3.24
May	3.22½	3.24
June	3.22½	3.24

Sales: Nil. Tendency: Quiet.

DJAKARTA

Some 50 tons of sheet No. 1 were sold on February 1 at 58 rupiahs per kilo. The market was quiet throughout the day but steadier.

	Rupiahs per kilo	
	Feb. 1	Prev.
Spot No. 1 Priok ..	57.50b	57.00b
Spot No. 2 Priok ..	56.50b	56.00b
Spot No. 3 Priok ..	55.50b	55.00b
No. 1 fine pale crepe, spot	53.50b	53.50b

Tendency: Steadier.

SINGAPORE

The market was easier on February 1 in slow dealings. At the lower levels some enquiry for lower sheet found sellers reserved. Factories were quiet. Little change was seen during the afternoon. Lower sheets met some interest. The market finished on a very quiet note. No. 1 RSS for February delivery was ⅞ of a cent below the previous final level at 114⅞ Malayan cents per lb. buyer.

	Straits cents per lb. fob Malayan ports to open ports	
	Feb. 1	Previous Close
No. 1 RSS, Feb.	114⅛–115	115⅛–116
Mar.	114⅛–115	115⅛–116
No. 2 RSS, Feb.	114⅛–114⅜	115 –115⅜
No. 3 RSS, Feb.	114 –114⅜	114⅜–115⅛
No. 4 RSS, Feb.	113 –114	114 –115
No. 5 RSS, Feb.	110½–111⅜	112⅛–114
No. 1 Spot ..	115⅜–116⅛	116⅛–117⅛
No. 3 blanket, thick remilled, Feb.	112⅛–114⅛	113 –115
No. 1 fine pale crepe, Feb. ..	132 –134	132½–134½
2X thin brown crepe, Feb. ..	112 –113	112⅞–113⅞

Tendency: Very quiet.

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums fob at 203.00d. per gallon.

NEW YORK

The New York rubber market ruled as follows on February 1:

DEALERS' PRICES

	US cents per lb. ex-dock	
	Feb. 1	Previous
No. 1 RSS, Feb...	40¼a	40¼a
Mar...	40¼a	40¼a
No. 2 RSS, Feb...	40¼a	40¼a
Mar...	40¼a	40a
No. 3 RSS, Feb...	40a	40a
Mar...	40a	39⅞a
No. 1 RSS, Spot..	40¼a	40¼a
No. 3 amber blanket, crepe, Apr.	39¾b–40a	39¾a
No. 1 latex, thin crepe, Feb. ..	44¼n	44n
No. 1 latex, thick crepe, Feb. ..	44¼n	44n

FUTURES—REX CONTRACT

	Close	Prev. Close
Mar. ..	40.15t	40.05t
May ..	39.35b–39.40a	39.35b–39.38a
July ..	38.75t	38.65b–38.80a
Sept. ..	38.08b–38.20a	38.15b–38.25a
Nov. ..	37.35b–37.50a	37.20b–37.40a
Jan. ..	36.70b–36.80a	36.50b–36.70a
Mar. ..	36.00b–36.25a	36.00b–36.30a

Sales: 34. Tendency: Steady.

Rubber futures were steadier in scattered trade buying on February 1 in thin dealings. In physicals, light dealer business took place. The undertone was steady. Factory buying was negligible. The earlier gain was later on pared by light selling.

BANGKOK

No. 1 RSS

The price of No. 1 RSS at Bangkok on February 1 was 36.25 (36.25) US cents per lb.

CEYLON

No. 1 RSS

The price of No. 1 RSS spot at Colombo on February 1 was 133 (136) Ceylon cents per lb.

CANADIAN ASBESTOS

A. L. Penhale, president and managing director of Asbestos Corporation Ltd., in a review, said that asbestos production in Canada was higher in 1959. In 1958, shipments totalled 925,000 tons, valued at over $92 million; comparable figures for 1959 are over one million tons at a value of somewhat less than $100 million dollars. This expected improvement amounting to approximately 8% has been achieved at a time when the industry has been faced with difficult marketing conditions brought about, in part, by increased competition in overseas markets from Russian fibre.

The general improvement in business conditions in North America was reflected in higher levels of sales to the US where the greatest volume of Canadian asbestos fibre is consumed. Overseas markets were influenced by a variety of economic and political factors. Notable amongst these was Western Europe which, as has been the case for several years now, was seriously and adversely affected by the supply of Soviet asbestos of comparable quality at prices well under Canadian.

The Japanese asbestos products industry continues to dominate the Far East and appears to be a growing and extremely important market for Canadian fibre. Other developments in this part of the world augur well for long-term sales prospects for asbestos cement materials, with which the Canadian asbestos industry is so vitally concerned.

In the face of rising costs and taxes, profit margins in the industry have undoubtedly been reduced. Nor is there much hope of relief: producers are presently facing intense competition at home and abroad, not only from foreign producers but also from competing materials. They are therefore alarmed at union demands for higher wages when it is imperative to prevent any further cost-price inflation, which could only result in further loss of markets.

Although the Canadian asbestos mining industry will undoubtedly encounter some difficulties throughout this year, the prospects for the longer term appear promising, and the growth pattern established in the post-war period should be resumed.

Nigerian Rubber

The price of rubber for the month of February 1960 for the purpose of assessing values of export duties will be 33.35d. per lb. against 34.65d. for January.

Industry INTELLIGENCE

Technical Data

Storing and Handling of Polysar Latices

There are three Polysar latices having styrene: butadiene (S:B) ratios and total solids (TS) as follows: Polysar Latex II, S:B 25:75, TS 27%. Polysar Latex IV, S:B 50:50, TS 42%. Polysar Latex 721, S:B 25:75, TS 62%. Techniques which have been found most suitable for the storage and handling of these latices are described by J. Dykstra and T. E. Dunfield in Polysar Technical Report No. 8:9C, distributed in the UK by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

Transportation, unloading and long-term storage of Polysar latices should not present any difficulties provided that proper precautions are taken against the destabilizing effect of certain mechanical and chemical actions. These are enumerated. Storage tanks should be lined with glazed tiles or baked-on phenolic-epoxy resin coatings. Items which should be incorporated into the design of latex storage tanks are listed. In the latex process equipment, some progressive fouling by coagulum is unavoidable over a period of time, and suggestions are put forward for the construction of equipment to minimize fouling and to make cleaning as easy as possible when required. The report concludes with recommendations regarding pumps and valves.

Boric Acid for Rubber Latex Preservation

The use of ammonia as the sole preservative for natural rubber latex has several disadvantages and consequently what are termed low-ammonia latices have been developed. These contain a relatively low proportion of ammonia, *e.g.* 0.2%, in conjunction with another preservative. One chemical which is being used as the additional preservative is boric acid, and this application of boric acid is described in Technical Service Bulletin 18 issued by Borax Consolidated Ltd., Borax House, Carlisle Place, London, S.W.1.

The proportions of boric acid and ammonia in the latex are arranged to provide ammonia slightly in excess of that required to form ammonium borate, the concentration of ammonium borate being equivalent to 0.2 to 0.3% boric acid. The procedure for adding boric acid to latex, as worked out by the RRI of Malaya, is described. As well as overcoming the disadvantages of high-ammonia preservation, the low-ammonia latices are stated to have excellent storage stability. Boric acid and amonium borate have the additional advantages of being innocuous materials, with no tendency to discolour latex films, and latex preserved with boric acid is said to have the best film colour of any of the low-ammonia latices. Successful results have been achieved with boric acid-preserved latex in the manufacture of foam rubber.

Effect of Temperature on Viscosity of Hexaplas Plasticizers

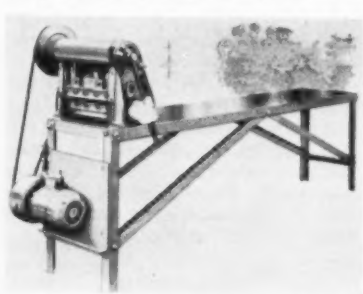
Data for the viscosity of Hexaplas PPA, Hexaplas LMV and Hexaplas PPL at a series of temperatures over the range 25° to 200°C. are given in Technical Information — Rubber PC/R.63, issued by the Polymer and Chemicals Service Department, Dyestuffs Division, Imperial Chemical Industries Ltd. The data are presented both numerically and graphically. At normal temperatures, Hexaplas LMV and PPL have a low viscosity but Hexaplas PPA has a high viscosity. Hexaplas PPA must therefore be warmed before it can be pumped easily and the data give an indication of the degree of heating required. It is inadvisable to hold Hexaplas PPA at elevated temperatures, since this encourages a rise in the acid value, and bulk storage should therefore be arranged so that the plasticizer is held at room temperature and heat is applied temporarily when pumping is to take place.

The tiles are manufactured by William Kenyon and Sons, Dukinfield, Cheshire, from whom a descriptive brochure can be obtained.

Machines, Materials and Equipment

Automatic Guillotine

The Besco Automatic Roll Feed Guillotine, recently introduced by F. J. Edwards Ltd., 359 Euston Road, N.W.1, is available in three sizes with a maximum blade width of 6in., 12in. and 18in. This machine for shearing plastics, rubber, etc., incorporates a unique feature; the feed adjustment to



the rollers can be varied from 0–96in. by altering the throw of the crank end by loosening the knurled nut and screwing the crank end spindle.

An indicator on the crank end spindle is set to the required figure stamped on the gib plate. A cutting action for each revolution of the crank is obtained only when the twelve steel trippers, located on the second shaft, are in position. A chart is supplied giving the number of trippers required for any desired length. Once the machine has been set to the predetermined length, it will continue shearing until switched off. Two guides are provided to keep the material square as it enters the feed rollers; these are adjustable for various material widths. The maximum thickness of material on the standard machines is ¼in., and the approximate capacity in mild steel is .024in. thick.

New Publications

Rubber at Low Temperature

Recent work at the British Rubber Producers' Research Association has extended the temperature range at which natural rubber will perform effectively. BRPRA Bulletin No. 4, 'Compounding Natural Rubber for Service at Low Temperatures,' just published, explains how, by the use of plasticizers and by chemical modification of the rubber, the lower limit for effective utilization can be brought down to at least −60°C. A previous booklet showed how the upper limit could be pushed to 125°C.

The cold-resistant compounds are, the bulletin says, 'suitable for numerous products such as window seals, tank tracks, vibration mountings, which are subject to service conditions as are met in high-flying aircraft, in the Polar regions, in deep-freeze equipment, etc.'

The bulletin, by S. G. Fogg and P. M. Swift, includes recipes for ten natural rubber based compounds for low temperature service, and is available free from the Natural Rubber Development Board, Market Buildings, Mark Lane, London, E.C.3.

Phthalic Anhydride

Phthalic anhydride is produced at both the Ruabon and Newport factories of Monsanto Chemicals Ltd., and the applications of this chemical are described in a 16-page brochure issued by the company. These applications include the production of (a) alkyd resins and modified alkyd resins, (b) polyester laminating resins and (c) phthalic ester plasticizers, as well as the use of phthalic anhydride as a curing agent for epoxy resins. The brochure includes data for the physical properties of phthalic anhydride, a table showing the compatibility of phthalate plasticizers with various resins and information on safe handling, health hazards and first aid in regard to phthalic anhydride. Copies can be obtained from Monsanto Chemicals Ltd., Monsanto House, 10-18 Victoria Street, London, S.W.1.

Future Events

INSTITUTION OF THE RUBBER INDUSTRY

Leicester Section.—Wednesday February 10 at the Bell Hotel, Leicester, at 7.30 p.m. 'Work Study Today,' by G. W. Lugg (Head of Work Study Unit of I.C.I. Ltd.).

London Section.—Tuesday February 9 at the National College of Rubber Technology, Holloway Road, London, N.7, at 5.30 p.m. 'Present Day Manufacture and Use of Reclaimed Rubber,' by W. E. Stafford, A.M.C.T., A.R.I.C., F.I.R.I., and D. Sargent, B.Sc., A.I.R.I. (Rubber Regenerating Co. Ltd.). At 7 p.m. 'Reaction of Sulphur Monochloride with Cyclohexene,' by Dr J. Glazer (N.C.R.T.) and 'A New Guard for 12in. Mills,' by D. J. Higgs, A.M.I.(Plant)E., C.N.C.R.T. (N.C.R.T.).

Merseyside Section.—Monday February 8 at the Exchange Hotel, Liverpool, at 7.15 p.m. 'Ageing and Weathering of Rubber and Some Plastics,' by Dr W. McG. Morgan and G. Hulse, B.Sc., A.I.P. (Monsanto Chemicals Ltd.). In the chair, R. I. Wood, F.R.I.C., chairman of the section.

Midland Section. — Monday February 8 at the James Watt Institute, Birmingham, at 6.45 p.m. 'Natural Rubber in Perspective,' by D. J. Flunder, M.Sc. (Dunlop Rubber Co. Ltd.). In the chair, W. D. Bradshaw, chairman of the section.

Preston Section.—Monday February 8 at the BTR Industries Social Club, Farington, Preston, at 7.15 p.m. 'An Accountant will Talk,' by P. A. Land (BTR Industries Ltd.). In the chair, G. H. Pearson, chairman of the section.

West of England Section.—Wednesday February 10 at the Melksham House, Melksham, at 7.45 p.m. 'Rubber and the Part it Plays in the Economy of Gt. Britain,' by a member of the FBRAM. In the chair, Mr W. A. Catte, A.I.R.I., chairman of the section.

PLASTICS INSTITUTE

South Wales Section. — Wednesday February 10 at 6.30 p.m. at the Angel Hotel, Cardiff. Ladies' night. Miss Eirlys Roberts, Research Director and editor of *Which* (Consumers' Association Ltd.).

Yorkshire Section.—Wednesday February 10 at St. Mark's House, 186 Woodside Lane, Leeds 2, at 7.15 p.m. K. A. Scott, B.Sc., A.R.I.C. (British Resin Products Ltd.), 'Polyester Resin Applications in Industry.'

Mr R. Bartram has been appointed to take charge of the development of all TyresoleS 'Off-the-Road' Services. He has been with the company since 1938.

PATENT LIST

Printed copies of the Specifications in the following list, published by permission of the Controller of H.M. Stationery Office, can be obtained from the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d., including postage, but about six weeks after the date of this publication will usually elapse before they come available. Orders with remittance may be sent in advance to the Patent Office, and will be fulfilled immediately the Specifications are published.

COMPLETE SPECIFICATIONS ACCEPTED

Open to public inspection on January 20 1960

Dunlop Rubber Co. Ltd. Electric resistance elements. 826,730.

Montecatini Soc. Generale Per L'industria Mineraria E Chimica. High molecular weight polymers of acetylenic hydrocarbons and process for preparing them. 826,674.

Minneapolis-Honeywell Regulator Co. Epoxy-ether resin compositions. 826,746.

B.F. Goodrich Co. Polyesters. 826,675.

Farbwerke Hoechst Aktiengesellschaft Vorm. Meister, Lucius and Brüning. Polyethylene moulding process. 826,748.

Imperial Chemical Industries Ltd. Mixed anhydrides and their use as catalysts for the polymerization of ethylenically unsaturated compounds. 826,787.

Monsanto Canada Ltd. Bicyclic guanidino compounds. 826,837.

Monsanto Canada Ltd. Arylsulphonyl derivatives of bicyclic guanidines. 826,838.

United States Rubber Co. Device for feeding plastic material to an extruder. 826,705.

Mac and Lai Co. (Malaya) Ltd. Preparation of rubber sheet. 826,709.

R. T. Beith. Means for mounting tubeless tyres. 826,813.

E. I. Du Pont De Nemours and Co. Organometallic catalysts. 826,829.

Deutsche Solvay-Werke G.m.b.H. Pentachlorophenyl acrylate and its polymers and copolymers. 826,831.

Open to public inspection on January 27 1960

Dunlop Rubber Co. Ltd. Anti-vibration mounting. 826,849.

Rohm and Haas Co. Polymeric amino organo vinyl ethers, and process for producing them. 826,945.

J. Allen Rubber Co. Ltd., A. A. Pace and J. Buttfield. Manufacture of gloves and like distensible articles. 826,946.

American Cyanamid Co. Production of stretched polyacrylonitrile filamentary material. 826,967.

E. I. Du Pont De Nemours and Co. Polymeric materials. 826,979.

Firestone Tire and Rubber Co. Method of producing essentially *cis* rubbery polyisoprene. 826,918.

Firestone Tire and Rubber Co. Polymerization of diolefins. 826,990.

N.V. Onderzoekingsinstituut Research. Process for the preparation of extrusion material from linear polyesters and linear polyamides. 826,920.

McNeill Machine and Engineering Co. Apparatus for curing pneumatic tyres. 827,006.

N.V. De Bataafsche Petroleum Maatschappij. Catalytic processes for the production of stereospecific polymers and catalysts for use in such processes. 826,908.

Open to public inspection on February 3 1960

Scovill Manufacturing Co. Valves for tubeless tyres. 827,524.

Distillers Co. Ltd. Polythene compositions. 827,363.

Distillers Co. Ltd. Polymerization process. 827,462.

Goodrich-Gulf Chemicals Inc. Production of conjugated polyolefin hydrocarbon polymers and copolymers. 827,365.

Distillers Co. Ltd. Polymerization process. 827,463.

Distillers Co. Ltd. Polmerization process. 827,461.

Farbwerke Hoechst Aktiengesellschaft Vorm. Meister Lucius and Brüning. Manufacture of products from a polyacrylonitrile or a copolymer of acrylonitrile. 827,480.

Farbwerke Hoechst Aktiengesellschaft Vorm. Meister, Lucius and Brüning. Manufacture of stable aqueous dispersions of synthetic resins capable of being hardened. 827,371.

Rottweiler Kunstseidefabrik A.G. Manufacture of terephthalic acid-glycol esters suitable for polycondensation. 827,373.

Thiokol Chemical Corporation. Preparation of polysulphide polymers. 827,375.

Francais Etat. Manufacture of isocyanates. 827,376.

Chemische Fabrik Pfersee G.m.b.H. Production of modified aminoplastic resins. 827,468.

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TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

BOSTIC (794,442) Compounds included in Class 17 based on rubber or synthetic rubber for use in bottoming footwear. B.B. Chemical Co. Ltd., Ulverscroft Works, Ulverscroft Road, Leicester. To be Associated with No. 555,433 (2966, 137) and others. (Class 17; December 23 1959).

INSTY (787,863) Expanded polystyrene plastics in the form of sheets, tubes, rods and shaped sections and included in Class 17. Commerce Factors (G.B.) Ltd., Torpoint, Cornwall. (Class 17; December 23 1959).

PANGOLIT (789,588) Compositions consisting principally of rubber. Pang Chemical Vulcanizers Ltd., Imperial House, Dominion Street, London, E.C.2. (Class 17; December 23 1959).

HAMAPAC (789,871) Materials included in Class 17 in the form of sheets, tubes and rods, all being goods of laminations of synthetic plastics and regenerated cellulose. Hamac A.G., Bahnhofstrasse 5, Zug, Switzerland. Address for service is c/o A. A. Thornton and Co., Northumberland House, 303-306 High Holborn, London, W.C.1. To be Associated with No. 789,435 (4236, 1135) and others. (Class 17; December 23 1959).

S. AND L. (792,161) Pipes and tubes, all included in Class 19 and being wholly or principally of synthetic resin plastics. Stewards and Lloyds Ltd., 41 Oswald Street, Glasgow, C.1 To be Associated

with No. 519,684 (2806, 9) and others. (Class 19; December 23 1959).

WILLORRPRINE (791,662) Materials made wholly or principally of plastics, all for use in padding and stuffing upholstery, furniture, mattresses and the like. Lintafelt Ltd., 14 Brewery Road, London, N.7, and East Works, Bower Street, Oldham, Lancashire. (Class 22; December 23 1959).

HOLI-WARM (B790,301) Bed covers made wholly or principally of foamed synthetic resin plastics. Gerard John Collins, 6, The Rise, Reading Road, Finchampstead, Berkshire. (Class 24; December 23 1959).

MAGNASTAT (792,688) Thermostatically-operated devices for automatically controlling the temperature of soldering irons and of heat-sealing irons for plastics. Weller Elektro-Werkzeuge Gesellschaft mit Haftung, Beschränkter Besigheim am Neckar, Germany. Address for service is c/o H. D. Fitzpatrick and Co., 3 Gray's Inn Square, London, W.C.1. (Class 9; December 30 1959).

NEW COMPANIES

C. L. Whitaker (Reinforced Plastics), Ltd. (646,683).—January 11. Capital: £5,000 in £1 shares. To carry on the business of manufacturers of and dealers in reinforced plastic and plastic materials of all kinds, etc. The permanent directors are: Clarence L. Whitaker, Airmyn, Station Road, New Waltham, Lincs.; Arthur W. Whitaker, Tarn Hows, Humberston Avenue, Humberston, Lincs.; and Alfred Whitaker, 7 Winston Avenue, Grimsby. Regd. office: Humber Bank South, Fish Docks, Grimsby.

Vitapol Ltd. (646,867).—January 13. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in foamed latex products and goods of all kinds made of rubber compounds, rubber foamed plastics, leather products, etc. The directors are: Norman Grimshaw, 62 Lees Road, Ashton-under-Lyne; Graham H. Smith, 312 Wilbraham Road, Chorlton-cum-Hardy, Manchester; director of Vitafoam Ltd., etc. Regd. office: Don Mill, Middleton, Manchester.

Harrisons and Crosfield (Borneo) Ltd. (F.4858).—January 8. Capital: $5,000,000 (Malayan) in 50,000 shares of $100. Registered in North Borneo on March 25 1918 to acquire and amalgamate the businesses carried on in Sandakan and Jesselton, British North Borneo as 'Darby and Co.' and carry on the business of importers, exporters, manufacturers, blenders and distributors of and dealers in rubber, etc. British address: 1/4 Gt. Tower Street, E.C.3. The directors are: Sir Leonard C. Paton, C.B.E., M.C., 3 Courtenay House, Hove, Sussex; Herman G. C. Townsend, O.B.E., Chathow, Watford Road, Radlett, Herts.; Gordon O. Peake, O.B.E., Heatherdale, St. Georges Hill, Weybridge; Sir James Mitchell, C.B.E., 54 Lennox Gardens, S.W.1; and Richard P. G. Brodie and Thomas Prentice, both of Sandakan, N. Borneo.

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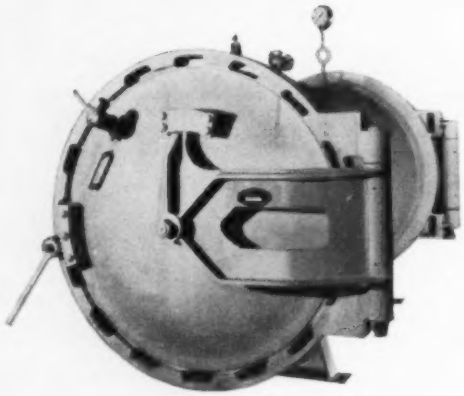

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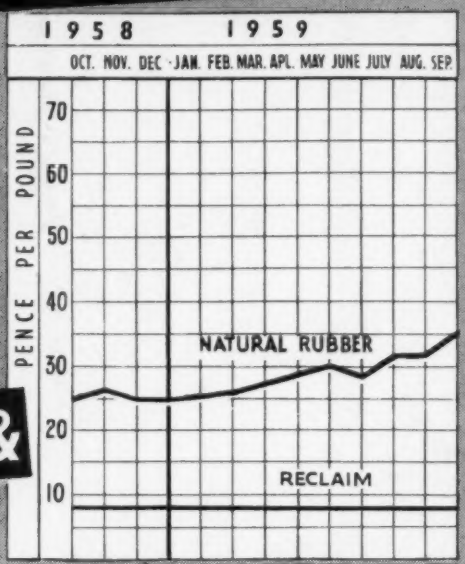

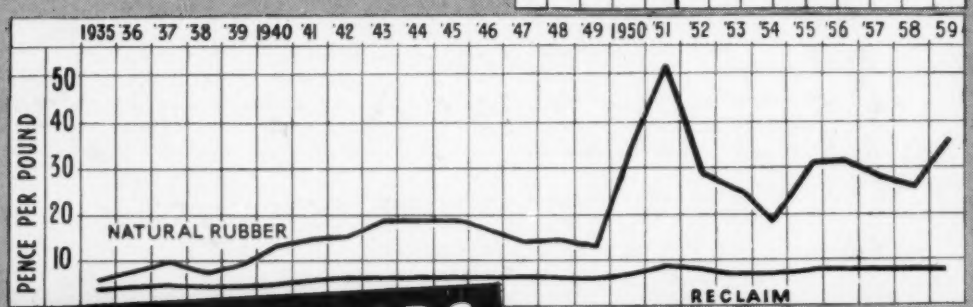

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